METALS LEACHING DATA

SANTORINI, GREECE

308 --- Q200408300007
Supplemental Material, Technical Activity
Supporting Documentation: Experimental Data
for Metals Leaching Data Santorini, Greece
(10/02/1992 through 10/13/1992)

Santorini Leaching Results

SAMPLE NO.			MgCl2 exchangeable								Carbonate fraction								Fe-Mn oxides					
	Cu	Ag	Co	Pb	Zn	Sn	Fe	Mn	Cu	Ag	Co	Pb	Zn	Sn	Fe	Mn	Cu	Ag	Co	Pb	Zn	Sn	Fe	Mn
Profiles																								
(Hole I)																								
SAN-021	1.05	0.94	4.87	5.91	0.57		5.50	5.67	1.49	1.50	5.30	4.71	1.36		0.00	13.55	2.12	0.00	7.15	5.52	4.13		62.09	83.32
SAN-028	1.24	0.83	4.25	5.41	0.55		1.13	4.25	2.99	0.70	4.84	4.75	1.17		0.00	15.82	1.86	0.00	2.45	4.52	3.27		127.45	34.45
SAN-036	1.11	0.83	6.19	6.47	0.59		1.52	3.75	1.83	0.84	4.79	3.88	1.76		8.43	8.32	0.70	0.00	1.91	4.49	1.62		121.81	13.43
SAN-044	0.74	0.97	4.76	4.94	0.52		3.63	4.53	1.53	0.82	5.03	4.69	1.76		9.86	7.28	0.65	0.15	1.67	4.67	1.51		74.87	10.55
(Hole II)																								
SAN-022	0.68	0.47	4.48	1.06	0.37		2.68	11.67	1.27	0.65	5.86	1.94	1.38		0.00	18.48	1.43	0.19	8.91	0.63	5.92		61.80	125.71
SAN-029	1.02	0.66	4.19	2.88	0.27		2.99	5.62	1.60	0.26	2.89	1.76	1.55		0.00	9.84	1.07	0.13	1.79	0.41	2.70		106.10	25.04
SAN-037	0.72	0.18	3.22	1.98	0.34		7.14	4.19	1.73	0.00	2.52	1.74	1.83		6.34	5.81	0.65	0.00	1.17	0.45	1.28		59.59	24.31
SAN-045	0.66	0.20	2.58	0.83	0.05		5.15	2.63	1.73	0.00	2.98	1.98	2.60		15.55	7.68	0.63	0.02	1.28	0.40	2.12		67.04	22.83
(Hole III)																								
SAN-023	1.16	1.01	2.75	3.91	0.71		0.84	9.64	1.88	0.85	3.22	5.05	0.79		4.80	20.16	2.47	0.51	5.22	4.12	5.30		39.06	117.94
SAN-030	0.84	0.85	4.13	2.11	0.58		1.96	2.48	1.87	0.82	4.04	6.14	1.28		0.90	10.43	1.11	0.04	1.85	7.53	2.20		101.68	24.50
SAN-038	1.01	0.73	5.12	4.01	0.32		1.15	2.34	1.67	0.54	3.82	4.15	1.94		0.00	10.98	0.88	0.13	1.32	7.52	1.73		99.14	16.17
SAN-046	0.73	0.58	5.55	3.47	0.28		1.13	3.55	1.50	0.35	3.27	3.55	2.15		2.97	9.08	0.57	0.65	1.19	5.88	1.54		105.60	17.74
(Hole IV)																								
SAN-024	0.70	0.27	3.63	4.36	0.09		2.95	20.49	1.76	0.39	6.55	2.38	1.07		2.03	23.67	1.77	0.31	9.79	2.22	6.41		46.50	83.42
SAN-031	0.54	0.26	2.52	1.38	0.16		0.70	2.88	2.52	0.21	6.67	1.86	0.77		4.90	11.44	1.89	0.43	3.22	1.54	4.03		55.38	36.80
SAN-039	0.17	0.20	2.92	2.77	0.15		1.78	1.59	2.14	0.12	2.46	2.33	1.66		11.30	8.81	0.42	0.69	0.53	0.93	1.67		98.92	12.83
SAN-047	0.51	0.20	3.00	2.38	0.05		2.12	2.96	1.83	0.24	0.81	0.92	1.75		6.25	6.25	0.25	0.70	0.53	1.44	1.56		82.03	6.80
(Hole V)																								
SAN-025	1.06	0.66	6.11	4.74	0.55		1.51	17.69	1.26	0.62	8.91	3.56	1.43		5.11	19.05	1.52	0.06	10.13	2.75	6.69		54.38	75.16
SAN-032	0.92	0.68	4.75	3.86	0.43		2.02	3.90	1.24	0.24	5.11	3.56	1.72		7.24	8.68	0.71	0.00	0.85	2.70	1.69		88.63	7.10
SAN-040	0.39	0.57	4.96	5.06	0.41		2.68	2.29	1.24	0.82	3.29	2.35	1.84		12.45	5.66	0.59	0.13	0.55	2.80	1.22		92.84	5.35
SAN-048	0.79	1.02	5.31	3.57	0.43		1.01	4.00	0.69	0.72	3.26	4.12	1.73		23.58	6.70	0.41	0.02	0.63	2.36	1.07		87.89	6.20
(Hole VI)																								
SAN-027	0.79	0.70	2.91	3.35	0.32		3.75	3.71	1.45	1.24	2.84	2.33	0.88		2.31	15.13	3.12	0.36	6.27	2.46	5.02		39.09	101.79
SAN-033	0.62	0.50	3.80	3.57	0.52		5.88	1.26	1.83	0.57	2.68	3.10	2.31		0.18	10.79	1.39	0.00	1.08	2.04	3.04		120.36	24.31
SAN-041	0.44	0.41	3.25	3.04	0.39		5.09	2.19	1.45	0.21	2.22	3.21	1.71		0.00	8.54	0.63	0.00	0.95	2.65	1.35		100.87	10.52
SAN-049	0.44	0.20	2.88	2.88	0.67		4.29	1.23	1.95	0.66	2.70	3.13	1.74		0.53	8.49	0.58	0.00	0.95	1.69	1.46		99.15	11.64

(Hole VII)																								
Bedrock																								
SAN-035	1.51	1.18	7.54	7.88	1.22		4.58	3.11	1.86	1.49	8.86	7.30	6.44		39.22	9.87	0.92	0.36	3.39	5.97	5.73		169.16	11.27
SAN-043	1.51	0.91	8.04	6.71	1.00		4.28	4.20	1.40	1.19	7.72	7.40	2.62		33.32	6.07	0.57	0.25	2.72	7.53	1.95		88.79	8.88
SAN-052	1.35	0.84	6.76	4.47	0.82		1.32	2.50	2.06	1.02	6.50	5.13	1.95		21.90	7.29	1.57	0.04	2.12	4.05	1.97		158.25	5.76
Bedrock with																								
fractures																								
SAN-026	1.73	1.12	6.85	5.59	0.96		0.34	1.11	2.04	1.25	7.52	7.55	3.55		7.24	11.82	1.17	0.53	2.80	7.13	5.31		127.50	16.36
SAN-034	0.95	0.73	5.59	2.52	0.16		1.32	3.61	2.37	0.60	8.45	7.53	1.65		25.44	13.96	2.36	0.25	2.20	7.00	4.20		211.89	17.03
SAN-042	1.39	0.84	6.23	4.72	0.79		3.51	4.01	2.47	1.10	6.41	5.76	1.91		12.13	8.69	1.82	0.08	4.87	4.03	3.78		179.35	13.00
SAN-050	1.27	0.81	6.50	5.25	0.78		2.48	4.63	2.36	1.17	4.89	5.23	1.98		24.62	5.96	0.94	0.04	1.31	4.47	1.55		95.53	6.81
SAN-051	1.43	1.14	5.33	7.38	1.35		1.74	4.67	2.66	1.62	5.20	6.80	2.12		6.62	8.24	2.90	0.40	3.23	6.97	4.99		106.90	25.15
Base Chemistry																								
SAN-053	0.86	0.67	8.62	2.00	0.76		5.17	5.04	1.13	0.65	6.26	1.87	2.64		14.52	9.42	0.84	0.55	2.49	2.29	2.69		174.29	11.59

		MgCl2							CO3							FeMnOx						
	Depth	Cu	Ag	Co	Pb	Zn	Fe	Mn	Cu	Ag	Co	Pb	Zn	Fe	Mn	Cu	Ag	Co	Pb	Zn	Fe	Mn
SAN-022	3.00	0.68	0.47	4.48	1.06	0.37	2.68	11.67	1.27	0.65	5.86	1.94	1.38	0.00	18.48	1.43	0.19	8.91	0.63	5.92	61.80	125.71
SAN-029	-4.50	1.02	0.66	4.19	2.88	0.27	2.99	5.62	1.60	0.26	2.89	1.76	1.55	0.00	9.84	1.07	0.13	1.79	0.41	2.70	106.10	25.04
SAN-037	-9.50	0.72	0.18	3.22	1.98	0.34	7.14	4.19	1.73	0.00	2.52	1.74	1.83	6.34	5.81	0.65	0.00	1.17	0.45	1.28	59.59	24.31
SAN-045	-12.00	0.66	0.20	2.58	0.83	0.05	5.15	2.63	1.73	0.00	2.98	1.98	2.60	15.55	7.68	0.63	0.02	1.28	0.40	2.12	67.04	22.83
SAN-023	1.00	1.16	1.01	2.75	3.91	0.71	0.84	9.64	1.88	0.85	3.22	5.05	0.79	4.80	20.16	2.47	0.51	5.22	4.12	5.30	39.06	117.94
SAN-030	-3.50	0.84	0.85	4.13	2.11	0.58	1.96	2.48	1.87	0.82	4.04	6.14	1.28	0.90	10.43	1.11	0.04	1.85	7.53	2.20	101.68	24.50
SAN-038	-8.50	1.01	0.73	5.12	4.01	0.32	1.15	2.34	1.67	0.54	3.82	4.15	1.94	0.00	10.98	0.88	0.13	1.32	7.52	1.73	99.14	16.17
SAN-046	-11.50	0.73	0.58	5.55	3.47	0.28	1.13	3.55	1.50	0.35	3.27	3.55	2.15	2.97	9.08	0.57	0.65	1.19	5.88	1.54	105.60	17.74
SAN-024	1.75	0.70	0.27	3.63	4.36	0.09	2.95	20.49	1.76	0.39	6.55	2.38	1.07	2.03	23.67	1.77	0.31	9.79	2.22	6.41	46.50	83.42
SAN-031	-4.00	0.54	0.26	2.52	1.38	0.16	0.70	2.88	2.52	0.21	6.67	1.86	0.77	4.90	11.44	1.89	0.43	3.22	1.54	4.03	55.38	36.80
SAN-039	-9.00	0.17	0.20	2.92	2.77	0.15	1.78	1.59	2.14	0.12	2.46	2.33	1.66	11.30	8.81	0.42	0.69	0.53	0.93	1.67	98.92	12.83
SAN-047	-11.00	0.51	0.20	3.00	2.38	0.05	2.12	2.96	1.83	0.24	0.81	0.92	1.75	6.25	6.25	0.25	0.70	0.53	1.44	1.56	82.03	6.80
SAN-027	-1.50	0.79	0.70	2.91	3.35	0.32	3.75	3.71	1.45	1.24	2.84	2.33	0.88	2.31	15.13	3.12	0.36	6.27	2.46	5.02	39.09	101.79
SAN-033	-4.00	0.62	0.50	3.80	3.57	0.52	5.88	1.26	1.83	0.57	2.68	3.10	2.31	0.18	10.79	1.39	0.00	1.08	2.04	3.04	120.36	24.31
SAN-041	-7.50	0.44	0.41	3.25	3.04	0.39	5.09	2.19	1.45	0.21	2.22	3.21	1.71	0.00	8.54	0.63	0.00	0.95	2.65	1.35	100.87	10.52
SAN-049	-12.50	0.44	0.20	2.88	2.88	0.67	4.29	1.23	1.95	0.66	2.70	3.13	1.74	0.53	8.49	0.58	0.00	0.95	1.69	1.46	99.15	11.64
r-squared		0.164	0.219	0.002	0.027	0.043	0.487	0.025	0.277	0.381	0.028	0.491	0.161	0.594	0.000	**0.721**	0.000	**0.826**	0.249	**0.720**	0.249	**0.720**
average r-squared		0.138							0.276							0.498						

Neg corr

Delta 3 Hole I

Sample Number	Depth cm	Error cm	MgCl2 Exchangeable Cu ppm	Ag ppm	Co ppm	Pb ppm	Zn ppm	Sn ppm	Fe ppm	Mn ppm	Carbonate Fraction Cu ppm	Ag ppm	Co ppm	Pb ppm	Zn ppm	Sn ppm	Fe ppm	Mn ppm	Fe-Mn Oxide Fraction Cu ppm	Ag ppm	Co ppm	Pb ppm	Zn ppm	Sn ppm	Fe ppm	Mn ppm
SAN-021	2.25	2.25																								
SAN-028	-2.50	2.50																								
SAN-036	-7.50	2.50																								
SAN-044	-12.00	2.00																								

Delta 3 Hole II

Sample Number	Depth cm	Error cm	MgCl2 Exchangeable Cu ppm	Ag ppm	Co ppm	Pb ppm	Zn ppm	Sn ppm	Fe ppm	Mn ppm	Carbonate Fraction Cu ppm	Ag ppm	Co ppm	Pb ppm	Zn ppm	Sn ppm	Fe ppm	Mn ppm	Fe-Mn Oxide Fraction Cu ppm	Ag ppm	Co ppm	Pb ppm	Zn ppm	Sn ppm	Fe ppm	Mn ppm
SAN-022	3.00	3.00	0.68	0.47	4.48	1.06	0.37		2.68	11.67	1.27	0.65	5.86	1.94	1.38		0.00	18.48	1.43	0.19	8.91	0.63	5.92		61.80	125.71
SAN-029	-4.50	4.50	1.02	0.66	4.19	2.88	0.27		2.99	5.62	1.60	0.26	2.89	1.76	1.55		0.00	9.84	1.07	0.13	1.79	0.41	2.70		106.10	25.04
SAN-037	-9.50	0.50	0.72	0.18	3.22	1.98	0.34		7.14	4.19	1.73	0.00	2.52	1.74	1.83		6.34	5.81	0.65	0.00	1.17	0.45	1.28		59.59	24.31
SAN-045	-12.00	2.00	0.66	0.20	2.58	0.83	0.05		5.15	2.63	1.73	0.00	2.98	1.98	2.60		15.55	7.68	0.63	0.02	1.28	0.40	2.12		67.04	22.83

Delta 3 Hole III

Sample Number	Depth cm	Error cm	MgCl2 Exchangeable Cu ppm	Ag ppm	Co ppm	Pb ppm	Zn ppm	Sn ppm	Fe ppm	Mn ppm	Carbonate Fraction Cu ppm	Ag ppm	Co ppm	Pb ppm	Zn ppm	Sn ppm	Fe ppm	Mn ppm	Fe-Mn Oxide Fraction Cu ppm	Ag ppm	Co ppm	Pb ppm	Zn ppm	Sn ppm	Fe ppm	Mn ppm
SAN-023	1.00	1.00	1.16	1.01	2.75	3.91	0.71		0.84	9.64	1.88	0.85	3.22	5.05	0.79		4.80	20.16	2.47	0.51	5.22	4.12	5.30		39.06	117.94
SAN-030	-3.50	3.50	0.84	0.85	4.13	2.11	0.58		1.96	2.48	1.87	0.82	4.04	6.14	1.28		0.90	10.43	1.11	0.04	1.85	7.53	2.20		101.68	24.50
SAN-038	-8.50	1.50	1.01	0.73	5.12	4.01	0.32		1.15	2.34	1.67	0.54	3.82	4.15	1.94		0.00	10.98	0.88	0.13	1.32	7.52	1.73		99.14	16.17
SAN-046	-11.50	1.50	0.73	0.58	5.55	3.47	0.28		1.13	3.55	1.50	0.35	3.27	3.55	2.15		2.97	9.08	0.57	0.65	1.19	5.88	1.54		105.60	17.74

Delta 3 Hole IV

Sample Number	Depth cm	Error cm	MgCl2 Exchangeable Cu ppm	Ag ppm	Co ppm	Pb ppm	Zn ppm	Sn ppm	Fe ppm	Mn ppm	Carbonate Fraction Cu ppm	Ag ppm	Co ppm	Pb ppm	Zn ppm	Sn ppm	Fe ppm	Mn ppm	Fe-Mn Oxide Fraction Cu ppm	Ag ppm	Co ppm	Pb ppm	Zn ppm	Sn ppm	Fe ppm	Mn ppm
SAN-024	1.75	1.75	0.70	0.27	3.63	4.36	0.09		2.95	20.49	1.76	0.39	6.55	2.38	1.07		2.03	23.67	1.77	0.31	9.79	2.22	6.41		46.50	83.42
SAN-031	-4.00	4.00	0.54	0.26	2.52	1.38	0.16		0.70	2.88	2.52	0.21	6.67	1.86	0.77		4.90	11.44	1.89	0.43	3.22	1.54	4.03		55.38	36.80
SAN-039	-9.00	1.00	0.17	0.20	2.92	2.77	0.15		1.78	1.59	2.14	0.12	2.46	2.33	1.66		11.30	8.81	0.42	0.69	0.53	0.93	1.67		98.92	12.83
SAN-047	-11.00	1.00	0.51	0.20	3.00	2.38	0.05		2.12	2.96	1.83	0.24	0.81	0.92	1.75		6.25	6.25	0.25	0.70	0.53	1.44	1.56		82.03	6.80

Delta 3 Hole V

Sample Number	Depth cm	Error cm	MgCl2 Exchangeable Cu ppm	Ag ppm	Co ppm	Pb ppm	Zn ppm	Sn ppm	Fe ppm	Mn ppm	Carbonate Fraction Cu ppm	Ag ppm	Co ppm	Pb ppm	Zn ppm	Sn ppm	Fe ppm	Mn ppm	Fe-Mn Oxide Fraction Cu ppm	Ag ppm	Co ppm	Pb ppm	Zn ppm	Sn ppm	Fe ppm	Mn ppm
SAN-025	1.00	1.00																								
SAN-032	-3.50	3.50																								
SAN-040	-8.50	1.50																								
SAN-048	-12.00	2.00																								

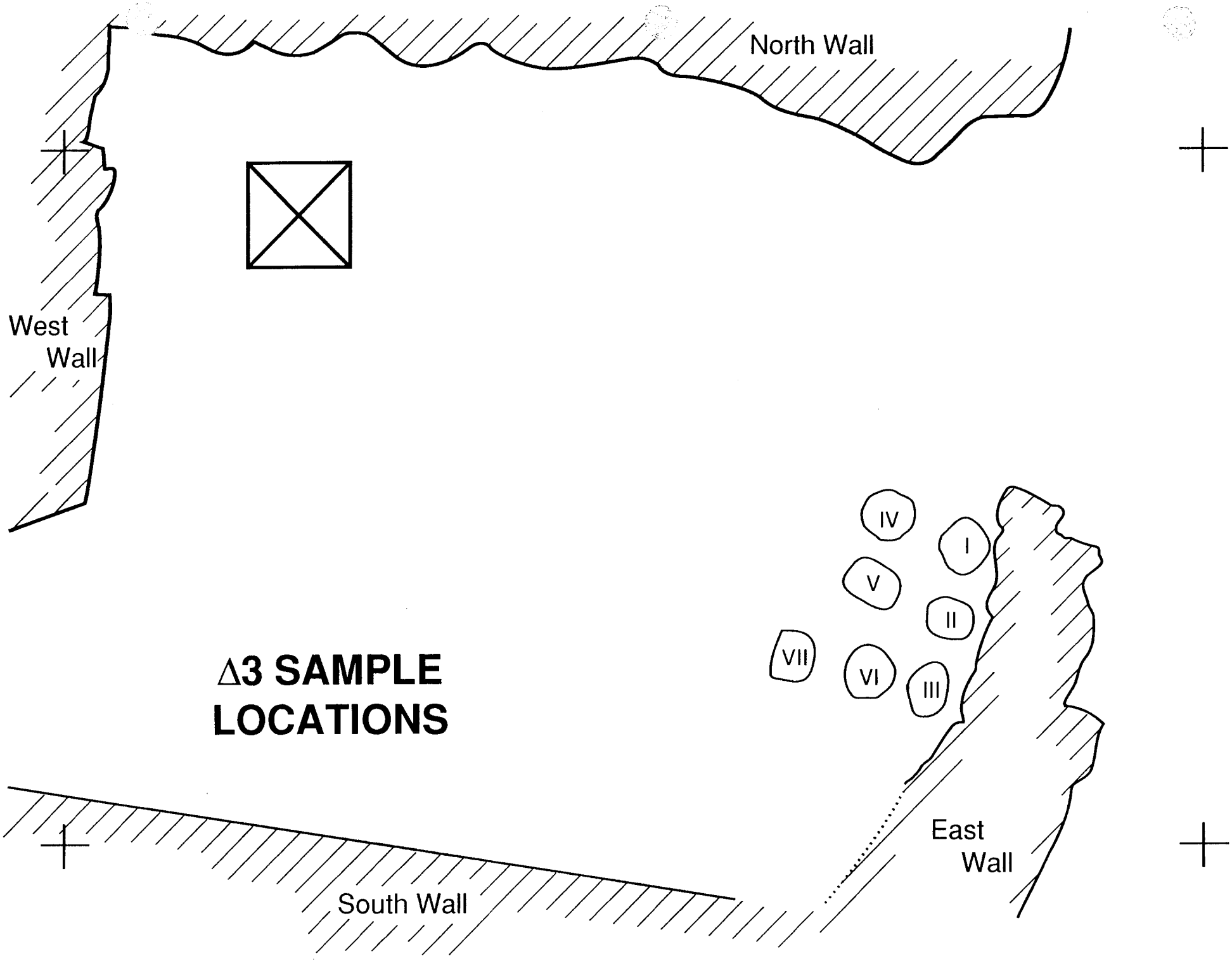
Delta 3 Hole VI

Sample Number	Depth cm	Error cm	MgCl2 Exchangeable Cu ppm	Ag ppm	Co ppm	Pb ppm	Zn ppm	Sn ppm	Fe ppm	Mn ppm	Carbonate Fraction Cu ppm	Ag ppm	Co ppm	Pb ppm	Zn ppm	Sn ppm	Fe ppm	Mn ppm	Fe-Mn Oxide Fraction Cu ppm	Ag ppm	Co ppm	Pb ppm	Zn ppm	Sn ppm	Fe ppm	Mn ppm
SAN-027	-1.50	1.50	0.79	0.70	2.91	3.35	0.32		3.75	3.71	1.45	1.24	2.84	2.33	0.88		2.31	15.13	3.12	0.36	6.27	2.46	5.02		39.09	101.79
SAN-033	-4.00	1.00	0.62	0.50	3.80	3.57	0.52		5.88	1.26	1.83	0.57	2.68	3.10	2.31		0.18	10.79	1.39	0.00	1.08	2.04	3.04		120.36	24.31
SAN-041	-7.50	2.50	0.44	0.41	3.25	3.04	0.39		5.09	2.19	1.45	0.21	2.22	3.21	1.71		0.00	8.54	0.63	0.00	0.95	2.65	1.35		100.87	10.52
SAN-049	-12.50	2.50	0.44	0.20	2.88	2.88	0.67		4.29	1.23	1.95	0.66	2.70	3.13	1.74		0.53	8.49	0.58	0.00	0.95	1.69	1.46		99.15	11.64

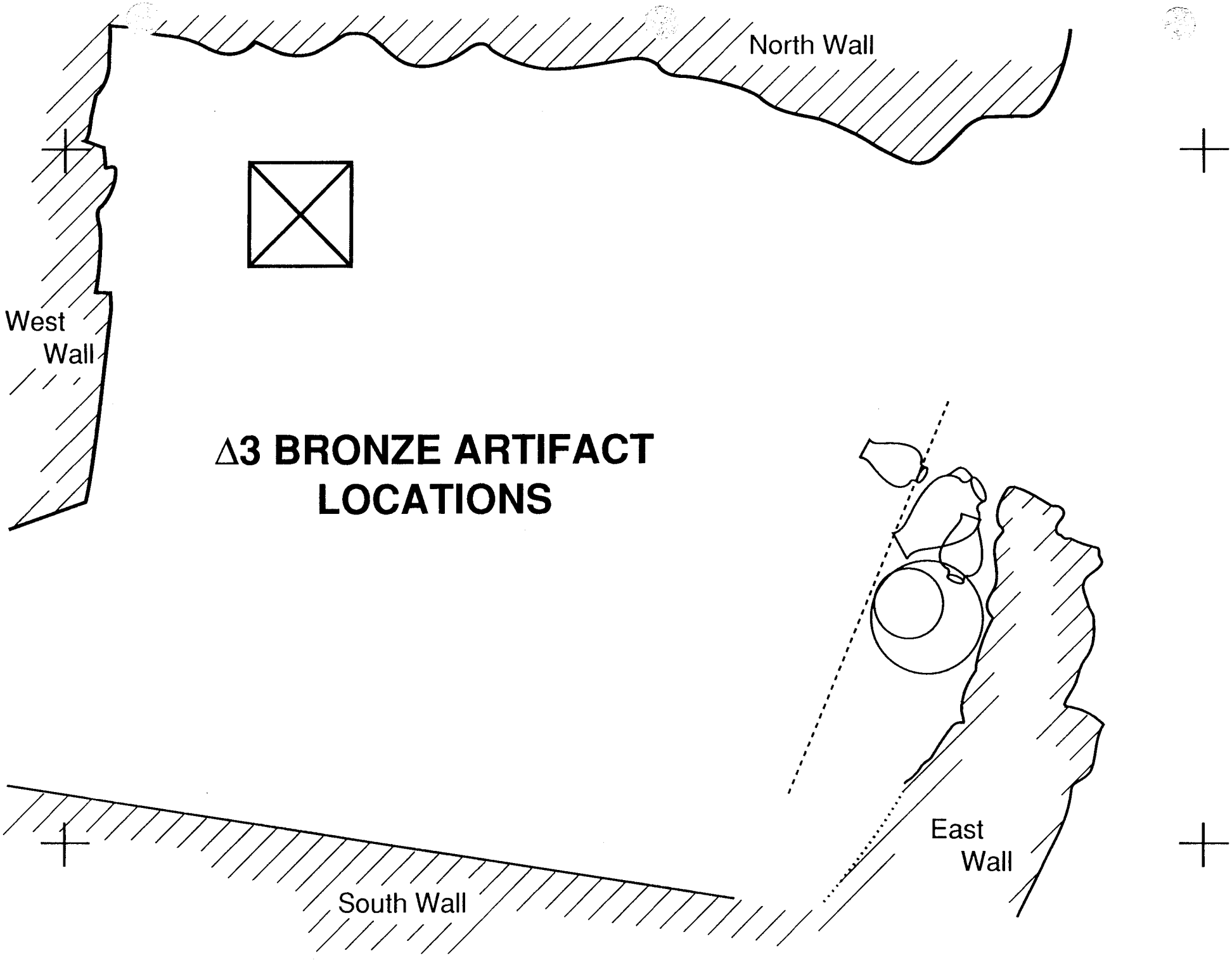
Delta 3 Hole VII

Cape Riva w/o fracture

Sample Number	Depth cm	Error cm	MgCl2 Exchangeable Cu ppm	Ag ppm	Co ppm	Pb ppm	Zn ppm	Sn ppm	Fe ppm	Mn ppm	Carbonate Fraction Cu ppm	Ag ppm	Co ppm	Pb ppm	Zn ppm	Sn ppm	Fe ppm	Mn ppm	Fe-Mn Oxide Fraction Cu ppm	Ag ppm	Co ppm	Pb ppm	Zn ppm	Sn ppm	Fe ppm	Mn ppm
SAN-035	-4.00	4.00																								
SAN-043	-9.50	1.50																								
SAN-052	-13.50	2.50																								
White coating in fracture SAN-034			0.95	0.73	5.59	2.52	0.16		1.32	3.61	2.37	0.6	8.45	7.53	1.65		25.44	13.96	2.36	0.25	2.2	7	4.2		211.89	17.03
Base Chemistry SAN-053			0.86	0.67	8.62	2	0.76		5.17	5.04	1.13	0.65	6.26	1.87	2.64		14.52	9.42	0.84	0.55	2.49	2.29	2.69		174.29	11.59



Δ3 SAMPLE LOCATIONS


North Wall
West Wall
Δ3 BRONZE ARTIFACT LOCATIONS
East Wall
South Wall

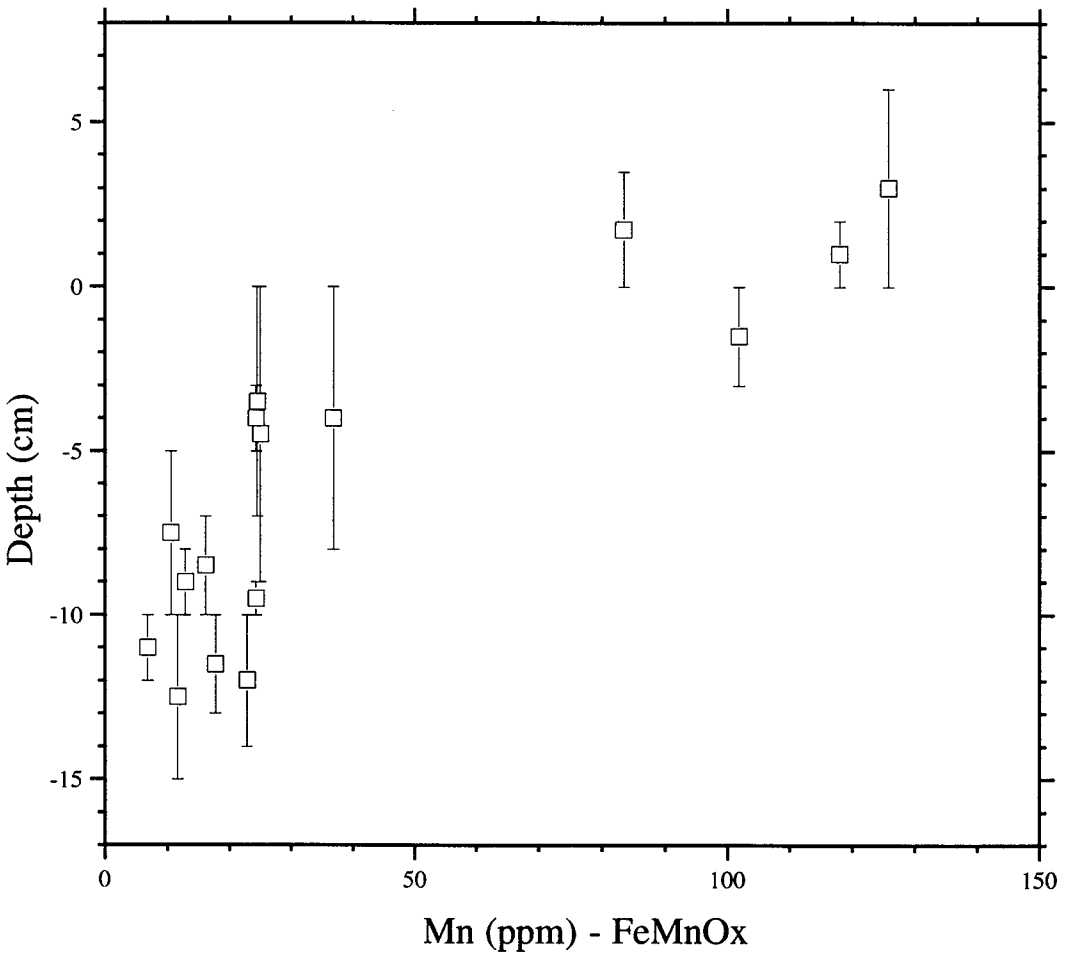
Delta 3 vertical profile samples

	Hole I		Hole II		Hole III		Hole IV		Hole V		Hole VI		Hole VII			
													Cape Riva w/o fracture		Cape Riva w/ fracture	
	Interval length cm	Sample Number	Interval length cm	Sample Number	Interval length cm	Sample Number	Interval length cm	Sample Number	Interval length cm	Sample Number	Interval length cm	Sample Number	Interval length cm	Sample Number	Interval length cm	Sample Number
Packed Earth	4.5	SAN-021	6.0	SAN-022	2.0	SAN-023	3.5	SAN-024	2.0	SAN-025	no packed earth here		no packed earth here		no packed earth here	
Cape Riva	5.0	SAN-028	9.0	SAN-029	7.0	SAN-030	8.0	SAN-031	7.0	SAN-032	3.0	SAN-027			4.0	SAN-026
Cape Riva	5.0	SAN-036	1.0	SAN-037	3.0	SAN-038	2.0	SAN-039	3.0	SAN-040	2.0	SAN-033	8.0	SAN-035	8.0	SAN-034
Cape Riva	4.0	SAN-044	4.0	SAN-045	3.0	SAN-046	2.0	SAN-047	4.0	SAN-048	5.0	SAN-041	3.0	SAN-043	3.0	SAN-042
											5.0	SAN-049	5.0	SAN-052	?	SAN-050
															?	SAN-051

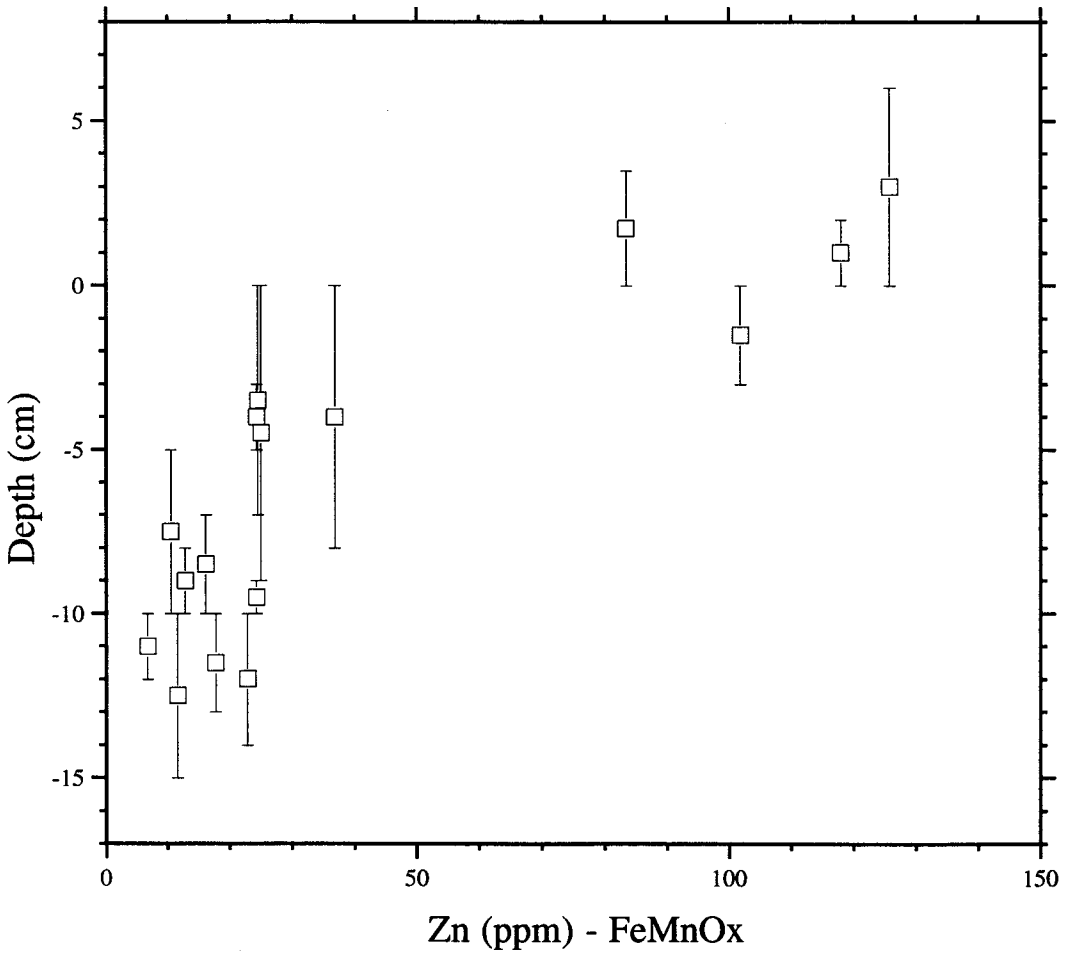
Take the top of the Cape Riva as a reference level because the thickness and existence of the Packed Earth is indeterminate across the sample area.
Depths are calculated from the top of the Cape Riva, so Packed Earth intervals will be positive numbers.
"Depth" means the vertical distance from the top of the Cape Riva to the center of the sample.
"Error" means the length range of the sample up and down from the center, calculated for plotting purposes.

	Hole I			Hole II			Hole III			Hole IV			Hole V			Hole VI			Hole VII				
																					Cape Riva w/o fracture		Cape Riva w/ fracture
	Depth cm	Error cm	Sample Number	Depth cm	Error cm	Sample Number	Depth cm	Error cm	Sample Number	Depth cm	Error cm	Sample Number	Depth cm	Error cm	Sample Number	Depth cm	Error cm	Sample Number	Depth cm	Error cm	Sample Number		Sample Number
Packed Earth	2.25	2.25	SAN-021	3.00	3.00	SAN-022	1.00	1.00	SAN-023	1.75	1.75	SAN-024	1.00	1.00	SAN-025	no packed earth here			no packed earth here			no packed earth here	
Cape Riva	-2.50	2.50	SAN-028	-4.50	4.50	SAN-029	-3.50	3.50	SAN-030	-4.00	4.00	SAN-031	-3.50	3.50	SAN-032	-1.50	1.50	SAN-027					SAN-026
Cape Riva	-7.50	2.50	SAN-036	-9.50	0.50	SAN-037	-8.50	1.50	SAN-038	-9.00	1.00	SAN-039	-8.50	1.50	SAN-040	-4.00	1.00	SAN-033	-4.00	4.00	SAN-035		SAN-034
Cape Riva	-12.00	2.00	SAN-044	-12.00	2.00	SAN-045	-11.50	1.50	SAN-046	-11.00	1.00	SAN-047	-12.00	2.00	SAN-048	-7.50	2.50	SAN-041	-9.50	1.50	SAN-043		SAN-042
																-12.50	2.50	SAN-049	-13.50	2.50	SAN-052		SAN-050
Total Depth	-14.0			-14.0			-13.0			-12.0			-14.0										SAN-051
(below Cape Riva top)																-15.00			-16.00				

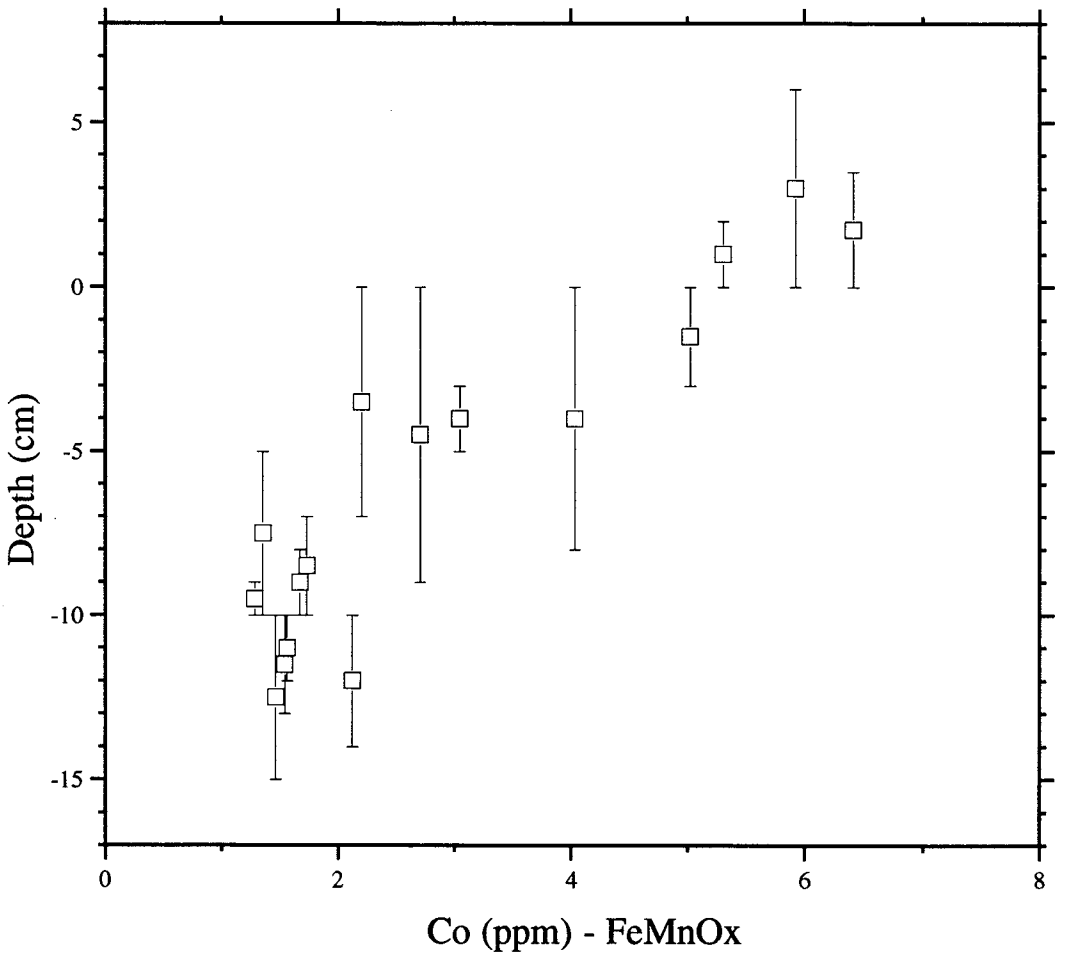
Delta 3 Profiles Corr. Data



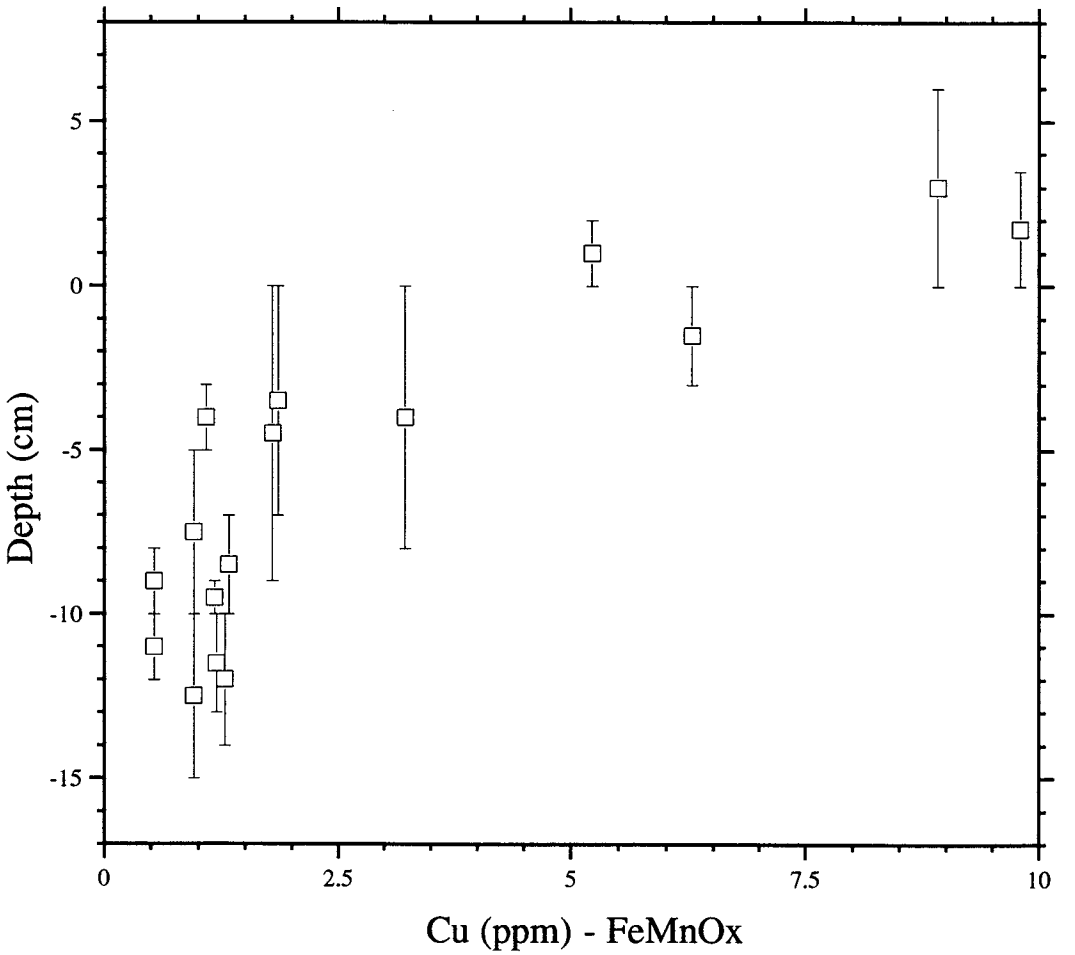
Delta 3 Profiles Corr. Data



Delta 3 Profiles Corr. Data



Delta 3 Profiles Corr. Data



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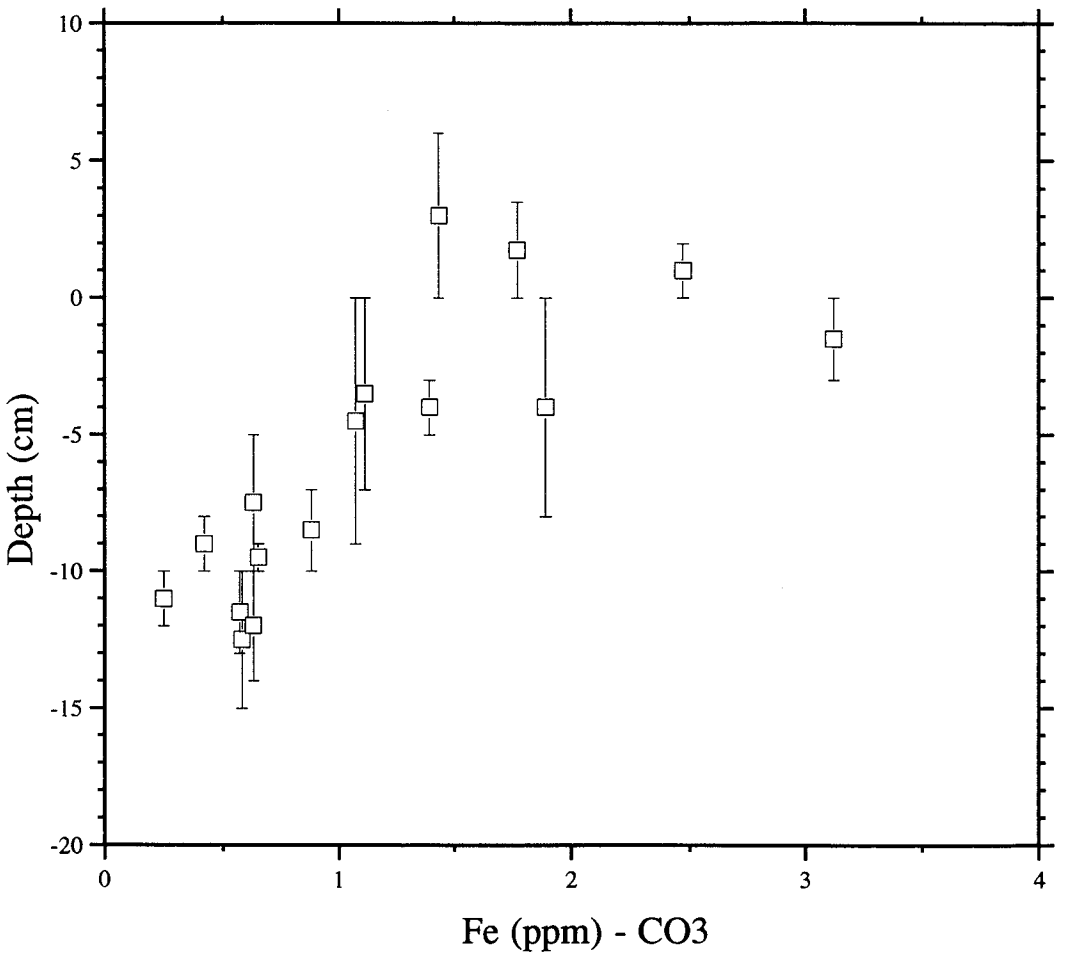
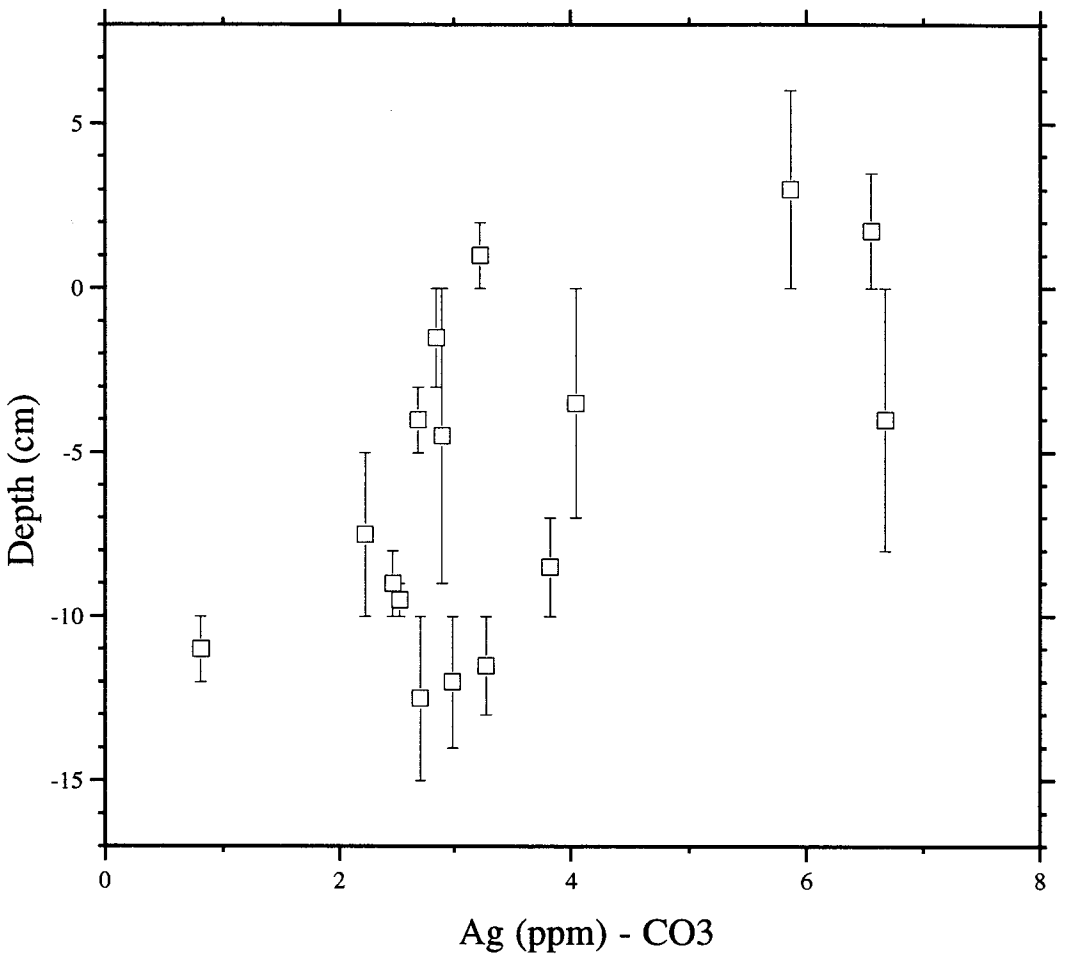
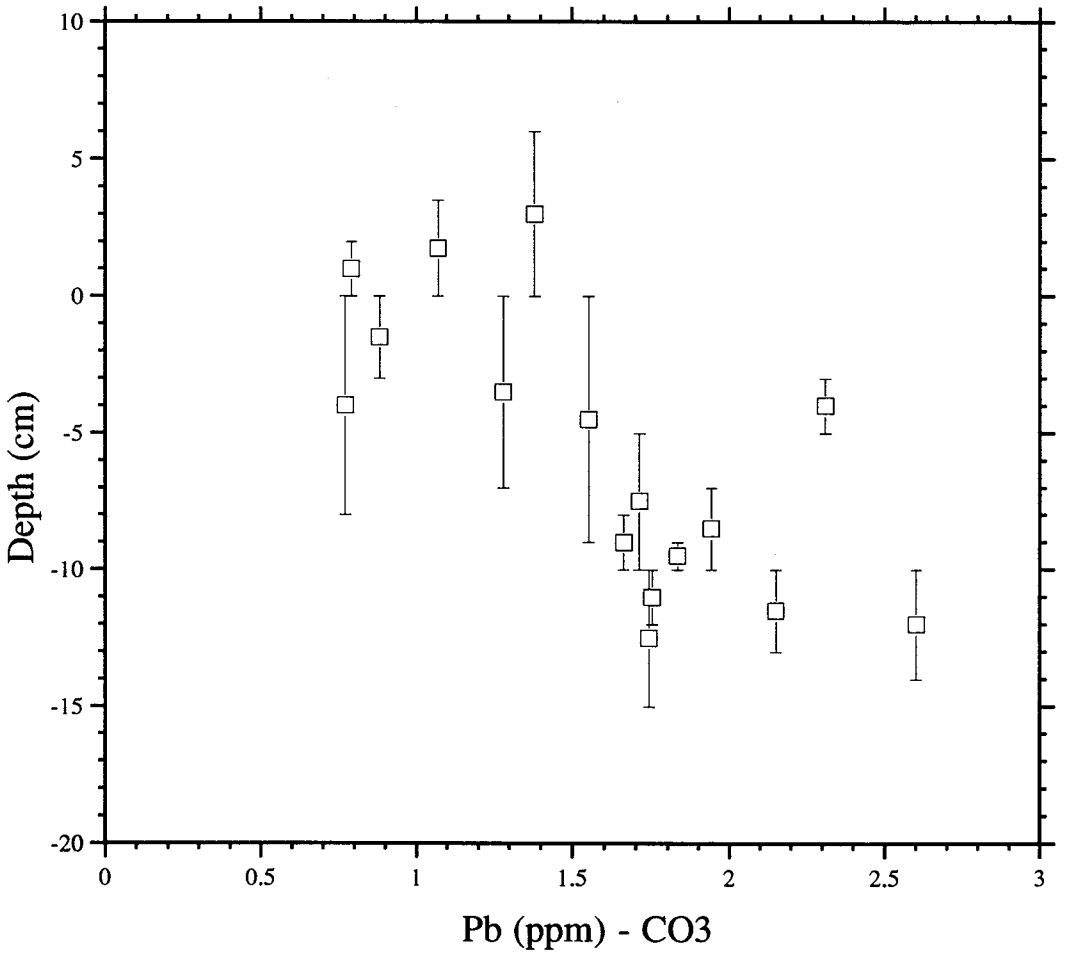


Delta 3 Profiles Corr. Data



Delta 3 Profiles Corr. Data



R MgCl2
B
G

MgCl2 reds

		San-023	SAN-030	SAN-034	SAN-038	SAN-046	SAN-053
A	Cu	004,005,005,004,004	003,004,004,003,003	003,002,003,003,003	003,002,003,002,003	003,003,003,002,002	002,003,003,002,002
	Ag	~~028 024~~ 004 005 004 004 004	006, 005, 005, 004, 004	003 003 004 004 004	004 003 004 004 004	004 004 004 004 004	003 004 004 004 003
	Co	007,007,006,006,006	010,009,010,009,010	013,013,013,012,013	012,012,012,012,012	012,013,012,012,012	020,020,020,019,020
	Pb	006, 005 005, 005, 005	003,004,003,003,004 ~~029,028,028,027,028~~	004, 004, 003, 004, 004	005, 005, 006,006,006	005, 006, 005, 004, 005	004, 003, 003, 004, 003
	ZN	010, 011, 010, 010, 009	007 007 007 006 007	003, 003, 002, 003, 002	004, 005, 006, 004, 005	003, 003, 003, 003, 003	010, 011, 010, 010, 010
B	Cu	050,052,050,051,050	050,049,049,050,050	052,050,051,053,051	053,055,054,054,054	054,053,054,054,053	057,054,055,054,056
	Ag	090, 090, 089, 089, 089	094, 094, 095, 095, 094	085 085 085 084 084	082, 083, 084, 083, 084	081, 081, 081, 082, 080	083 083 084 084 083
	Co	043,043,045,044,044	046,046,046,046,046	048,049,049,048,049	048,049, 049,048,049	048,049,048,048,049	055,055,056,056,055
	Pb	027 028 028, 027, 028	026, 027, 027, 026, 027	028, 027, 029, 029, 027	029, 031, 030, 030, 031	027, 028, 029, 028, 029	025, 026, 024, 024, 026
	ZN	127, 128, 128, 129, 127	122, 121, 122, 120, 121	114, 113, 113, 112, 113	115, 115, 114, 115, 116	115, 114, 116, 117, 115	120, 122, 121, 120, 121
C	Cu	101,102,102,103,100	101,100,101,099,102	100,099,100,099,098	103,101,102,101,101	105,104,104,106,104	105,106,105,106,107
	Ag	167 170 167 169 166	166, 168, 167, 166, 166	163, 167, 165, 164 165	162, ~~164~~ 164, 161, 164, 165	165, 164, 162, 164, 166	164 163, 164, 164 166
	Co	080,080,081,080,081	082,083,082,082,083	084,085,085,084,086	085,084,086,085,086	085,085,084,083,085	091,093,092,091,09
	Pb	051, 050 051 050 051	051, 051, 051, 049, 052	052, 051, 051, 053, 051	052, 053, 052, 054, 054	050, 051, 052, 051, 051	050, 049, 050 048, 050
	ZN	242, 243, 242, 243, 240	227, 228, 226, 227, 227	225, 227, 225, 224, 225	228, 227, 225, 224, 228	223, 220, 225, 222, 222	230, 230, 229 234, 226

M

NaOAc green

		SAN-023	SAN-030	SAN-034	SAN-038	SAN-046	SAN-053
A	Cu	006, 007, 008, 005, 007	007, 007, 007, 007, 006	009, 008, 009, 008, 008	006, 006, 006, 005, 006	006, 006, 005, 005, 005	004, 005, 005, 004, 004
	Ag	003 003 003 004 003	003 003 003 003 003	002 002 002 002 002	002 002 002 002 002	002 002 002 002 002	002 002 003 002 002
	Co	008, 007, 008, 007, 008	010, 010, 010, 009, 010	020, 020, 020, 021, 020	009, 009, 009, 009, 009	008, 008, 008, 007, 008	014, 014, 015, 015, 014
	Pb	007, 008, 009, 008, 008	010, 011, 010, 011, 010	011, 012, 013, 013, 013	007, 006, 007, 006, 007	006, 006, 006, 005, 005	003, 003, 002, 004, 002
	Zn	010, 010, 011, 011, 011	018, 017, 017, 018, 018	024, 023, 024, 024, 024	026, 028, 028, 026, 027	029 029 029 029 028	034, 035, 035, 034, 034
B	Cu	061, 063, 061, 060, 062	063, 062, 063, 062, 062	062, 064, 063, 065, 064	061, 060, 063, 062, 061	060, 061, 060, 061, 061	057, 057, 058, 058, 057
	Ag	062 062 061 063 063	061 060 059 061 061	055 055 055 056 055	060 061 060 059 059	062 063 064 063 063	050 051 049 050 052
	Co	046, 046, 046, 047, 046	048, 049, 048, 049, 048	058, 058, 058, 059, 057	046, 048, 047, 048, 047	047, 045, 047, 045, 046	052, 051, 053, 051, 053
	Pb	034, 034, 035, 033, 034	036, 037, 036, 035, 037	038, 037, 038, 038, 039	032, 032, 031, 032, 033	030, 031, 032, 030, 029	027, 026, 027, 026, 026
	Zn	131, 130, 132, 132, 133	137, 137, 136, 137, 138	138, 142, 137, 138, 138	144, 145, 148, 144, 143	145, 146, 146, 145, 147	151, 149, 149, 148, 149
C ?	Cu	117, 114, 117, 116, 117	120, 118, 119, 118, 118	119, 118, 119, 119, 121	115, 117, 117, 117, 116	117, 115, 118, 116, 115	114, 114, 114, 113, 113
	Ag	108 109 103 106 108	109 107 109 108 107	097 098 096 098 095	110, 112, 111, 110, 110	127 127 129 127 127	099 099 100 102 100
	Co	085, 083, 085, 085, 084	087, 086, 086, 087, 087	095, 097, 095, 096, 097	085, 084, 084, 084, 084	084, 084, 084, 083, 083	088, 089, 090, 088, 087
	Pb	060, 059, 058, 058, 059	063, 062, 063, 064, 064	064, 065, 064, 065, 063	057, 057, 057, 057, 057	055, 055, 054, 054, 055	050, 051, 050, 050, 050
	Zn	248, 242, 246, 244, 245	251, 248, 249, 247, 248	255, 255, 254, 254, 250	258, 253, 253, 255, 254	249, 252, 256, 251, 251	253, 252, 253, 252, 253

½ OH blue

		SAN-023	SAN-030	SAN-034	SAN-038	SAN-046	SAN-053
A	Cu	.010 .011 .011 .010 .011	005 005 005 005 005	011 010 010 010 011	005 004 003 004 004	003 002 002 002 003	004, 003, 004, 002, 003
	Ag	001 001 001 001 001	001, 001, 001, 001, 000	002 002 001 001 001	000, 001, 000, 000, 000	001 001 000 001 001	001 001 001 001 001
	Co	015, 015, 015, 015, 015	006, 005, 006, 005, 006	015, 014, 014, 015, 014	004, 004, 004, 004, 004	003, 004, 004, 003, 004	007, 007, 007, 008, 007
	Pb	.008, 009, 008, 009, 008	014, 014, 014, 015, 015	013, 013, 013, 012, 014	014, 014, 012, 014, 013	011, 010, 011, 011, 010	005, 006, 003, 003, 005
	Zn	102, 107, 100, 097, 099	042, 041, 042, 042, 042	077, 079, 078, 080, 078	033, 032, 033, 033, 034	028, 029 029, 028, 028	047, 047, 048, 048, 048
B	Cu	078 077 077 080 077	071 070 070 070 071	075 076 075 075 076	071 072 071 070 072	071 072 070, 071, 071	070, 070, 071, 070, 071
	Ag	073 073 073 072 072	069, 068, 070, 070, 070	071, 070, 071, 070, 069	062, 059, 059, 060 061	072 071 071 071 071	062 061 063 060 061
	Co	062, 062, 061, 062, 062	053, 054, 053, 054 052	060, 061, 061, 062, 060	051, 051, 052, 051, 051	051, 052, 050, 051, 051	054, 055, 054, 053, 054
	Pb	037, 038, 037, 037, 036	043, 042, 042, 043, 044	042, 042, 041, 042, 043	041, 041, 044, 041, 041	036, 038, 035, 034, 035	033, 032, 032, 032, 031
	Zn	270, 269, 276, 273 270	196, 198, 196, 199, 196	229, 231, 230, 233, 234	189, 189, 185, 188, 188	183, 186, 184, 184, 186	206 205 203 203 205
C	Cu	126 128 125 125 127	137 136 137 139 138	144 142 144 143 144	139 140 139 140 139	139, 140, 139, 138, 139	137, 136, 136, 136, 135
	Ag	137, 135, 138, 137, 138	141, 142, 141, 143, 141	141, 141, 142, 141, 140	118, 116, 120, 120, 117	130, 128, 131, 130, 131	118 117 117 114 114
	Co	109, 107, 106, 105, 107	100, 102, 099, 102, 100	109, 109, 108, 108, 110	098, 099, 098, 099, 098	098, 099, 099, 098, 098	097, 102, 101, 100, 101
	Pb	069, 069, 067, 068, 069	072, 074, 072, 074, 073	072, 071, 070, 072, 072	070, 069, 070, 069, 069	065, 062, 066, 064, 062	060, 061, 062, 061, 062
	Zn	411, 413, 412, 421, 411	343, 349, 350, 342 346	380, 380, 377, 378, 377	331, 338, 340, 338, 341	328, 335, 336, 332, 330	345 343 344 346 345

.198

$MgCl_2$ - D

		SAN-023	SAN-030	SAN-034	SAN-038	SAN-046	SAN053
A	Fe	000 001 000 002 000	001 002 001 002 002	000 001 001 000 001	001 001 001 000 001	002 001 001 001 000	004 005 002 002 004
	MN	11 12 11 12 11	4 3 3 3 5	5 4 4 4 4	3 3 1 3 3	4 5 5 5 3	7 6 6 7 7
B	Fe	047 048 047 048 049	48 48 47 48 49	48 49 52 49 49	048 049 049 047 048	048 050 049 048 049	051 050 051 051 048
	MN	62 63 64 64 62	53 52 53 54 52	54 55 55 54 54	53 55 54 54 54	54 53 55 55 55	55 56 54 56 56
C	Fe	096 096 097 097 093	95 98 96 98 98	96 96 99 97 98	096 097 096 096 095	098 098 098 099 098	098 099 .100 097 099
	MN	111 111 111 111 110	103 107 104 104 104	103 104 103 103 102	102 105 102 103 102	106 103 104 104 102	106 107 106 105 105

Fe 1 ppm 2 ppm

MN .05 ppm 1 ppm

NaOAc green

		SAN-023	SAN-030	SAN034	SAN038	SAN046	SAN-053
A	Fe	1 3 2 2 2	0 0 1 0 1	8 8 11 8 8	0 0 0 0 0	0 1 2 0 2	7 5 4 8 6
	Mn	26 25 26 25 26	14 13 14 13 13	19 17 17 17 18	15 13 13 12 13	11 13 10 10 13	12 13 11 11 11
B	Fe	35 35 36 34 33	35 36 35 36 34	35 36 37 34 35	26 29 33 30 31	26 27 29 26 29	38 37 39 40 40
	Mn	74 75 75 74 73	64 63 64 63 64	64 67 66 66 67	63 62 65 63 64	62 60 62 63 63	062 61 61 64 62
C	Fe	75 75 75 73 77	80 79 80 77 80	76 79 77 74 76	67 66 69 70 70	66 63 63 62 66	83 81 83 82 83
	Mn	123 125 124 127 122	114 114 113 113 116	118 116 117 113 118	110 111 111 112 109	112 112 110 111 112	112 110 110 111 112

NH_2OH blue

		SAN-023	SAN-030	SAN-034	SAN-038	SAN-046	SAN-053
A	Fe	10 9 8 10 8	25 23 25 23 23	47 50 50 47 46	24 24 21 25 21	22 24 24 23 27	39 37 38 37 36
	Mn	61 62 62 60 61	12 13 12 13 13	10 8 8 9 10	9 7 8 10 9	7 8 7 9 8	6 5 4 6 5
B	Fe	54 57 56 56 56	72 67 68 70 71	93 93 93 91 94	71 73 71 70 69	72 70 73 70 70	82 82 84 86 85
	Mn	112 114 115 114 112	65 63 63 63 64	59 60 62 62 60	61 62 62 61 61	65 63 63 64 63	58 57 57 58 59
C	Fe	102 103 103 101 101	116 116 113 118 114	139 139 136 136 139	116 115 116 115 116	116 116 113 114 115	125 126 123 124 125
	Mn	166, 162, 164, 161, 164	114 113 113 115 115	113 114 113 113 110	114 113 114 114 113	111 111 109 110 111	108 107 109 106 107

$MgCl_2$ rec

		SAN-027	SAN-033	SAN-041	SAN-049
A	Cu	3 3 3 3 3	2 3 1 2 2	1 2 3 2 1	2 3 1 1 1
	Ag	5 4 4 4 4	3 3 3 2 3	3 2 2 3 3	2 3 2 3 2
	Co	6 7 7 8 7	9 9 9 8 8	8 8 8 8 7	7 7 7 7 7
	Pb	5 6 5 6 4	5 6 6 5 5	4 4 5 5 5	5 5 5 4 4
	Zn	5 5 5 4 5	5 6 4 5 5	6 5 5 6 5	9 8 9 9 9
B	Cu	55 57 55 56 56	55 56 56 56 56	55 55 56 55 54	55 55 55 55 56
	Ag	78 78 78 78 79	77 77 77 77 78	77 78 77 77 78	77 77 77 78 76
	Co	44 44 44 44 45	44 44 45 45 44	43 43 44 43 43	42 42 42 42 42
	Pb	31 31 31 31 29	29 29 30 30 29	29 29 29 30 30	29 29 29 28 30
	Zn	123 123 121 123 123	128 127 130 129 128	126 125 125 128 126	128 125 129 127 128
C	Cu	110 110 111 110 111	110 110 108 110 108	111 109 110 110 110	109 109 110 109 109
	Ag	157 158 156 158 157	155 155 155 153 153	154 155 157 157 156	156 157 155 157 155
	Co	82 82 82 81 83	81 80 80 79 81	81 79 80 81 82	80 79 80 78 79
	Pb	56 55 55 55 55	53 53 53 54 53	54 54 53 53 53	54 54 52 55 54
	Zn	240 240 242 241 240	234 238 233 237 238	244 245 242 248 240	242 236 241 242 238

NaOAc green

		SAN-027	SAN-033	SAN-041	SAN-049
A	Cu	6 5 6 5 5	7 7 7 7 6	5 5 6 5 5	6 7 7 6 7
	Ag	2 3 2 2 2	1 1 1 1 1	0 0 1 0 1	1 1 1 1 1
	Co	8 7 7 7 7	7 6 7 7 6	5 6 6 6 5	6 7 7 7 7
	Pb	4 3 4 5 5	5 5 5 6 6	6 5 6 5 5	5 5 6 4 6
	ZN	12 13 12 12 13	115 115 116 114 114	25 26 26 25 26	26 25 26 26 26
B	Cu	64 61 63 63 63	64 64 64 65 64	62 63 64 64 63	064 064 064 064 065
	Ag	30 30 30 31 30	17 17 17 16 16	31 31 30 30 30	25 24 25 25 25
	Co	44 45 44 45 45	44 45 44 45 45	44 43 44 45 45	45 44 45 45 44
	Pb	30 30 30 29 30	30 31 31 30 31	32 31 30 31 31	31 31 31 30 30
	ZN	138 137 136 135 138	149 152 150 149 148	147 145 144 146 144	146 145 146 146 144
C	Cu	120 120 121 120 122	123 122 123 122 122	119 121 121 121 120	120 118 121 118 119
	Ag	32 33 33 34 33	34 34 35 35 34	53 52 55 53 53	30 29 30 29 30
	Co	85 85 83 83 84	84 83 82 ~~88~~ 85	83 83 85 84 83	83 83 85 83 84
	Pb	57 57 56 57 58	58 57 56 58 58	57 57 58 57 58	56 57 56 57 56
	ZN	253 257 255 256 252	265 265 267 265 265	263 262 264 265 264	262 260 263 264 264

NH_2OH blue

		SAN-027	SAN-033	SAN-041	SAN-044
A	Cu	12 13 15 14 13	6 6 6 6 5	3 3 3 3 3	3 3 4 2 3
	Ag	1 0 1 1 1	0 0 0 0 0	0 0 0 0 0	0 0 0 0 0
	Co	18 18 17 17 17	4 3 3 3 4	3 3 3 3 2	2 3 3 3 3
	Pb	~~1 1 1 1 1~~ 6 5 5 4 4	~~0 0 0 0 0~~ 4 4 4 4 4 ~~2 2 2 2 2~~	~~0 0 0 0 0~~ 6 6 6 5 5	~~0 0 0 0 0~~ 4 4 3 3 3
	Zn	87 87 86 86 86	51 54 53 52 51	24 24 23 24 24	25 25 24 25 25
B	Cu	81 81 81 82 81	73 74 73 73 73	70 70 69 69 70	69 69 69 69 70
	Ag	36 35 35 35 36	25 26 25 25 25	32 32 32 31 32	18 18 18 18 18
	Co	62 62 63 62 62	47 48 48 48 48	47 47 47 48 47	47 47 48 47 47
	Pb	~~12 12 12 12 12~~ 31 33 34 33 33	~~11 11 11 11 11~~ 34 ~~35~~ 33 33 ~~30~~ 33 34	~~10 11 11 10 10~~ 34 34 34 35 35	~~10 10 10 10 10~~ 33 33 32 32 32
	Zn	228 226 227 233 226	194 193 194 193 194	170 171 166 167 164	169 168 166 165 166
C	Cu	149 149 151 149 148	140 140 140 141 140	137 135 141 137 139	137 136 140 138 140
	Ag	63 62 62 61 61	38 38 38 36 39	47 46 48 47 48	54 55 57 55 56
	Co	105 106 107 107 105	95 94 93 93 94	91 93 92 93 93	92 93 90 92 93
	Pb	~~23 24 23 24 24~~ 62 63 64 62 62	~~23 22 23 23 23~~ 65 ~~64~~ 64 ~~65 64~~	~~23 22 23 22 22~~ 67 67 67 65 65	~~21 22 22 21 22~~ 62 64 62 64 62
	Zn	362 364 362 361 362	328 334 325 331 326	304 312 307 311 306	302 304 301 304 303

$MgCl_2$ red

		SAN-027	SAN-033	SAN-041	SAN-049
A	Fe	1 2 2 3 1	3 3 4 4 3	3 4 4 3 3	3 3 3 2 2
	Mn	3 3 5 3 3	2 2 1 2 2	1 2 2 2 0	0 2 0 2 2
B	Fe	49 50 48 51 48	48 49 48 51 49	48 49 47 49 50	49 48 47 49 47
	Mn	41 42 41 40 41	38 37 38 37 37	40 41 40 43 42	38 39 40 40 39
C	Fe	96 93 95 95 93	95 94 94 95 96	99 95 95 95 97	95 94 93 94 95
	Mn	78 78 77 77 79	76 78 76 78 76	76 78 77 76 77	77 77 77 78 78

NaO: ~~Spec~~

		SAN-027	SAN-033	SAN041	SAN-044
A	Fe	3 0 2 0 0	0 0 0 0 1	0 0 0 0 1	1 0 0 0 0
	Mn	14 16 15 14 15	10 9 12 11 12	8 7 7 8 9	6 8 8 8 8
B	Fe	45 43 42 40 42	42 44 45 43 43	44 46 45 44 42	44 45 44 45 43
	Mn	52 52 52 55 51	48 47 48 49 47	46 47 45 46 47	47 47 47 48 48
C	Fe	83 81 84 84 82	86 87 89 85 88	90 90 89 93 90	88 89 86 89 86
	Mn	90 91 91 91 92	87 86 89 87 86	82 84 84 82 81	83 83 83 86 83

NH_4OH blue

		SAN-027	SAN-033	SAN-041	SAN-049
A	Fe	9 10 9 10 10 9 ~~13 12~~	29 30 31 30 29	25 24 23 24 23	25 25 24 24 23
	Mn	40 39 38 39 40	8 9 8 9 9	4 4 4 4 4	4 4 5 5 4
B	Fe	~~60 63 63 62 59~~ 58 59 59 61 61	78 77 78 78 78	74 73 73 72 76	72 73 69 68 71
	Mn	79 78 78 80 81	49 48 47 48 47	42 43 42 43 43	41 41 45 43 43
C	Fe	~~109 107 108 109 109~~ 108 109 107 109 110	126 127 128 127 127	118 122 122 123 121	121 117 118 120 119
	Mn	116 117 115 117 116	82 85 84 82 84	80 81 82 81 80	82 81 80 81 78

$MgCl_2$ 28

		SAN-022	SAN 029	SAN-037	SAN-045
A	Cu	2 3 2 2 2	3 3 3 3 3	3 2 2 3 2	3 2 3 2 2
	Ag	1 ~~1 1 0 0~~ 2 2 2 2	2 3 2 2 2	1 1 1 1 1	1 1 1 1 1
	Co	10 10 10 9 9	9 9 8 9 8	7 6 7 7 7	5 6 6 6 6
	Pb	2 3 2 2 1	4 4 4 4 4	3 3 3 3 2	1 1 1 1 2
	Zn	5 6 6 6 6	4 3 5 4 4	5 6 5 4 5	0 1 1 1 1
B	Cu	56 55 56 55 56	57 57 57 56 56	55 55 55 54 55	54 55 55 54 55
	Ag	~~71 70 71 70 70~~ 73 74 72 72 71	73 74 74 73 73	70 71 70 71 70	70 69 72 71 71
	Co	42 43 42 43 43	42 43 42 41 40	41 39 40 41 39	38 39 41 39 40
	Pb	24 25 24 25 25	27 27 26 27 26	25 25 25 25 24	24 25 24 23 23
	Zn	122 123 124 125 122	121 123 124 122 120	122 123 120 123 120	118 118 117 117 118
C	Cu	109 109 110 107 108	109 108 107 108 108	106 109 106 108 108	110 108 107 106 108
	Ag	140 144 142 140 141 ~~142 140 142 141 139~~	141 139 142 139 141	141, 142, 139, 142, 140	142 143 142 138 139
	Co	76 77 76 75 76	74 75 74 75 71	74 72 73 73 73	73 74 76 73 74
	Pb	48 51 50 49 49	48 48 49 50 48	47 47 47 48 46	46 46 48 46 46
	Zn	241 242 242 241 242	229 230 227 234 233	224 225 225 225 225	226 225 223 223 224

MgCl2 (ne)

		SAN 024	SAN 031	SAN 039	San 047
A	Cu	~~4 5 3 5 4~~ 3 2 3 3 3	2 2 2 2 2	1 1 1 1 1	2 2 2 2 2
	Ag	2 1 1 1 1	2 2 1 1 1	~~2 1 1 1 1 1~~ ~~7 8 7 7 7~~	1 1 1 1 1
	Co	7 7 7 8 8	6 5 6 6 6	~~10 10 9 10 9~~	6 6 7 7 6
	Pb	6 7 6 6 6	3 3 2 4 4	3 5 5 5 4	~~12 12 12 12 12~~
	ZN	1 1 1 2 1	3 2 2 2 2 ~~1 1 0 1 1~~	1 1 1 1 1	4 4 4 3 3 0 1 1 1 1
B	Cu	~~59 60 59 60 59~~ 59 58 58 57 57	56 58 56 57 56	55 55 55 55 56	56 57 56 57 56
	Ag	73 72 71 72 72	72 72 73 72 72	72 72 71 71 71	71 72 71 71 71
	Co	43 43 43 44 43	38 39 39 39 39	38 37 37 38 38 ~~43 44 44 43 43~~	38 38 38 37 37 ~~43 43 45 44 44~~
	Pb	30 30 29 29 28	26 28 27 28 26	28 28 28 27 27	27 27 27 27 28
	ZN	119 118 118 117 119	~~117 116 119 119 120~~ 117 117 116 118 119	121 121 119 120 119	131 130 128 129 131
C	Cu	~~117 116 114 118 117~~ 114 116 116 114 113	114 112 111 112 111	112 111 112 112 113	112 113 112 112 112
	Ag	141 144 144 144 142	145 145 144 144 144	144 144 144 144 142	143 142 142 141 143
	Co	76 76 76 75 76	74 74 74 73 74	~~78 78 76 78 78~~ 69 69 70 70 69	~~78 79 77 78 78~~ 71 72 69 69 69
	Pb	52 51 53 51 51	51 53 51 52 53	53 53 52 51 51	51 51 50 51 51
	ZN	235 233 237 231 235	231 232 231 234 230	231 234 229 232 232	227 226 227 230 231

$MgCl_2$ (red)

		SAN 022	SAN029	SAN 037	SAN045
A	Fe	~~1~~ 0 0 1 2 2 2	2 1 1 3 1	4 2 4 5 4	3 3 6 4 2
	MN	~~10 10 10 11 11~~	~~1 0 1 1 1~~	~~0 0 0 1 0~~	4 4 3 2 3
	SN	13 14 15 13 15	6 5 6 7 8	4 6 5 6 6	~~0 0 0 0 0~~
B	Fe	43 47 47 44 47	47 46 45 47 47	49 49 51 49 51	44 47 47 46 44
	MN	~~57 55 57 59 57~~	~~45 45 46 45 47~~	~~44 43 44 44 43~~	49 48 49 50 50
	SN	60 60 60 61 61	52 53 53 55 52	51 49 49 51 49	
C	Fe	89 89 90 90 88	92 91 90 90 91	93 94 93 94 95	91 91 92 96 90
	MN	~~105 105 104 107 106~~	~~90 94 90 91 91~~	~~89 89 90 90 87~~	94 97 97 96 94
	SN	107 109 108 107 105	98 99 99 98 98	96 96 96 99 98	

NaOAc (s)

		SAN 024	SAN 031	SAN 039	SAN 047
A	Cu	6 6 7 7 7	10 9 9 9 9	9 7 9 8 8	7 7 7 7 7
	Ag	1 1 1 1 1	1 1 1 1 1	1 1 1 1 1	1 1 1 1 1
	Co	14 14 15 14 14	15 15 15 15 15 ~~13 13 13 13 14~~	5 6 5 5 6 ~~3 4 4 4 4~~	4 4 4 4 4 ~~0 1 1 1 1~~
	Pb	4 3 4 4 4	3 3 3 3 3	3 3 3 3 3	2 2 2 1 1 ~~3 3 1 1 2~~
	Zn	15 16 15 15 15	11 10 10 10 10	23 23 23 23 23	25 25 25 24 26
B	Cu	65 65 65 64 63	68 67 68 68 68	64 64 64 64 65	64 63 63 64 63
	Ag	66 69 67 66 67	67 67 67 66 68	63 65 64 64 64	67 66 66 66 66
	Co	47 47 48 47 47	49 ~~47~~ 49 ~~47 47~~ 50 50	40 40 40 40 39 ~~37 37 37 37 37~~	37 38 37 37 38 ~~34 35 34 35 35~~
	Pb	27 27 27 27 27	25 26 25 26 27	30 28 29 29 29	25 25 25 25 25
	Zn	136 135 138 135 137	132 134 134 135 135	145 147 145 143 142	147 146 147 147 145
C	Cu	122 121 122 124 125	125 125 126 125 126	123 123 123 123 122	121 222 120 123 122
	Ag	129 130 128 131 130	135 134 134 134 132	130 131 130 129 130	131 132 131 130 133
	Co	83 ~~79~~ 81 82 ~~79~~ 82	~~82 81 84 82 82~~ 85 84 85 85 84	~~72 70 71 71 71~~ 74 74 74 76 74	75 74 73 72 72 ~~69 71 69 68 69~~
	Pb	51 51 51 52 52	49 50 50 50 51	51 52 51 52 52	49 50 49 49 50
	Zn	253 252 ~~250~~ 252 253	250 247 246 248 250	255 254 261 ~~255~~ 257	258 260 262 260 260

NaOAc green

		SAN-022	SAN-029	SAN037	SAN045
A	Cu	4 4 5 5 4	6 7 6 6 6	6 6 6 6 6	7 6 7 5 6
	Ag	2 2 1 1 1	0 1 0 1 0	0 0 0 0 0	0 0 0 0 0
	Co	14 12 14 13 13	6 7 7 7 7	7 6 6 6 5	6 7 7 7 7
	Pb	3 3 3 4 3	3 3 3 3 3	3 3 3 3 3	3 3 3 3 3
	Zn	19 19 19 19 19	23 22 23 22 22	29 29 29 28 29	38 37 37 37 37
B	Cu	59 61 61 60 61	60 61 60 61 61	61 62 61 62 62	61 61 60 62 62
	Ag	63 62 63 62 61	62 62 63 62 64	61 60 60 62 61	60 59 61 58 60
	Co	47 48 48 49 48	42 42 43 41 42	41 42 41 41 42	43 42 41 41 42
	Pb	25 26 25 27 25	25 25 25 25 25	25 25 25 26 25	26 26 25 26 25
	Zn	137 138 140 138 138	138 137 137 140 141	151 152 154 151 153	152 151 151 155 156
C	Cu	116 115 118 115 114	119 118 118 118 118	117 115 116 118 117	116 116 116 118 118
	Ag	121 117 116 114 118	123 122 121 122 119	121 123 121 125 122	120 120 118 120 119
	Co	83 81 85 82 85	78 78 79 80 77	79 77 78 77 80	79 78 78 77 76
	Pb	49 49 51 50 51	49 48 50 50 49	49 50 50 50 50	49 50 49 49 48
	Zn	251 247 250 249 250	250 252 253 255 252	251 255 254 252 255	268 266 264 264 266

.0068
.0042
.7784

NaOAc (grind)

		SAN-022	SAN025	SAN037	SAN045
A	Fe	0 1 1 0 0	0 0 0 1 0	4 4 4 4 3	9 9 9 10 9
	MN	21 21 21 21 22	11 11 11 11 10	7 7 7 7 7	~~7 6 6 7 5~~
	SN				11 10 10 11 12
B	Fe	38 41 39 38 40	40 37 40 40 40	46 48 51 47 47	51 52 52 51 53
	MN	68 67 65 66 67	59 58 59 59 59	52 53 52 53 51	~~51 50 52 52 52~~
	SN				57 57 56 56 56
C	Fe	83 81 81 78 80	81 82 80 80 80	93 92 93 92 94	99 95 99 95 98
	MN	111 111 112 113 110	100 104 103 102 103	97 99 100 98 99	~~104 105 102 105 105~~
	SN				107 109 110 109 111

NH_2OH blue

		SAN022	SAN029	SAN037	SAN045
A	Cu	6 7 6 6 6	5 5 4 5 5	4 3 3 3 3	3 2 3 3 3
	Ag	1 0 2 1 1	1 1 1 0 1	0 0 0 0 0	0 1 0 0 1
	Co	23 22 23 24 23	5 5 5 4 5	3 4 4 3 4	4 4 3 4 3
	Pb	1 1 1 1 2	1 1 1 1 1	1 1 1 2 1	1 1 1 1 1
	Zn	96 95 95 97 95	45 45 45 45 44	22 21 20 22 22	33 33 33 33 32
B	Cu	72 71 71 72 71	69 69 70 70 70	65 68 67 67 67	67 68 68 67 68
	Ag	73 74 76 73 73	72 71 71 73 72	72 71 72 74 73	72 71 73 72 74
	Co	65 63 65 64 63	45 46 45 46 47	46 45 44 46 46	44 45 45 44 46
	Pb	29 28 28 28 28	27 27 27 27 28	27 27 28 28 28	27 28 28 28 28
	Zn	229 230 226 229 228	180 177 181 181 181	158 156 153 158 157	171 168 170 170 171
C	Cu	139 137 136 137 139	138 135 136 135 137	133 134 134 134 133	134 134 134 133 133
	Ag	146 148 147 146 148	142 144 146 144 143	146 144 143 146 145	146 141 148 147 148
	Co	102 107 104 103 105	87 89 87 88 85	89 88 89 91 90	88 86 85 89 87
	Pb	55 56 56 56 56	55 55 54 56 55	56 56 57 56 57	56 56 57 56 56
	Zn	349 352 354 354 353	318 301 311 311 310	288 288 291 285 291	293 293 293 294 294

NH_2OH blue

		SAN024	SAN031	SAN039	SAN047
A	Cu	7 7 7 8 9	9 9 8 9 8	2 2 2 2 2	2 2 1 1 1
	Ag	1 1 1 1 1	2 2 2 2 2	3 3 3 3 3	3 3 3 3 3
	Co	24 24 24 24 24	8 8 8 8 8	~~0 0 0 0 0~~ 1 1 1 2 2	2 2 2 2 1 ~~0 0 0 0 0~~
	Pb	4 5 4 4 4	3 3 3 3 3	3 2 2 2 2	2 3 3 3 3
	ZN	109 109 112 108 108	77 78 79 78 79	28 29 27 27 27	27 26 26 27 27
B	Cu	73 75 75 74 73	73 74 74 74 74	69 69 69 68 68	67 69 68 69 68
	Ag	77 79 77 77 78	79 78 78 79 78	78 80 80 78 79	76 79 77 78 78
	Co	63 63 62 61 63	47 46 46 45 46	~~59 39 39 39 40~~ 43 43 43 43 44	41 42 42 42 42 ~~40 39 40 40 40~~
	Pb	31 32 32 32 32	30 30 31 31 31	29 29 30 30 29	31 30 32 30 30
	ZN	239 237 241 242 244	232 230 230 230 225	168 168 170 170 169	167 170 167 171 170
C	Cu	142 142 142 140 139	143 142 139 142 144	135 139 136 136 135	135 137 136 137 139
	Ag	151 151 154 149 151	154 155 153 155 155	156 151 153 152 154	151 148 151 150 152
	Co	102 102 102 100 101	84 85 85 85 83	~~80 79 80 80 80~~ 84 85 85 85 85	86 85 84 84 84 ~~80 80 80 80 81~~
	Pb	60 61 61 61 61	60 60 60 59 59	58 60 59 61 59	59 60 59 55 60
	ZN	376 373 375 378 375	348 348 353 346 350	299 301 302 300 305	304 306 306 303 304

NH_4OH 6he

		SAN022	SAN029	SAN037	SAN045
A	Fe	11 15 15 13 16	25 24 24 23 24	14 12 12 12 11	15 14 14 16 16
	Mn	58 57 57 59 58	12 12 12 12 12	9 9 11 11 11	11 10 10 10 11
	Sn				
B	Fe	58 57 56 57 57	65 67 68 68 67	58 56 57 57 56	60 59 58 58 57
	Mn	104 105 104 105 103	58 59 58 59 58	55 57 58 58 56	56 57 56 55 55
	Sn				
C	Fe	104 100 99 100 104	114 112 109 111 112	95 97 99 96 98	103 102 104 101 102
	Mn	151 149 146 148 148	103 107 106 103 107	98 98 100 100 98	102 99 101 102 100
	Sn				

$MgCl_2$ wb

		SAN-024	SAN-031	SAN-039	SAN-047
A	Fe	~~3 2 6 3 3~~ 2 1 2 2 2	0 0 0 1 0	1 1 0 3 0	0 1 2 0 1
	Mn	25 25 25 26 27	3 4 3 5 3	2 1 0 2 3	3 3 3 4 4
B	Fe	47 46 47 45 48	48 45 44 47 42	46 43 45 44 48	47 44 45 47 48
	Mn	75 75 75 75 74	52 53 51 53 53	51 52 52 52 53	55 53 54 53 52
C	Fe	94 91 93 90 93	89 91 90 87 88	92 91 89 88 88	86 92 91 91 86
	Mn	125 124 124 122 124	103 102 102 101 98	99 101 101 101 99	100 102 103 100 102

NaOAc ~~green~~

		SAN-024	SAN-031	SAN-039	SAN-047
A	Fe	1 2 0 2 0	2 2 3 2 2	5 5 4 6 7	3 3 5 4 0
	Mn	28 30 29 29 29	~~16 16 15 19 17~~ 14 14 14 14 13	11 12 10 10 10	8 9 8 8 7
B	Fe	45 42 45 43 43	43 46 45 45 45	50 51 51 50 52	47 46 47 44 42
	Mn	78 79 79 79 80	~~66 68 68 68 67~~ 62 63 62 61 62	61 61 59 60 60	57 57 58 57 56
C	Fe	87 87 83 86 86	85 86 82 86 86	94 89 91 92 92	83 86 86 90 83
	Mn	129 125 127 125 127	~~115 116 115 117 117~~ 109 110 109 109 109	109 109 107 106 108	108 107 106 106 107

NH_2OH blue

		SAN024	SAN031	SAN039	SAN-047
A	Fe	10 10 10 11 11	14 10 13 15 11	24 22 19 21 20	18 19 17 21 21
	Mn	40 42 41 41 41	18 19 17 17 19	6 6 5 5 5	3 3 4 3 3
B	Fe	57 38 55 55 58	59 60 59 59 57	67 67 65 68 65	68 64 65 65 65
	Mn	92 92 92 92 93	68 68 69 68 69	54 54 54 55 54	54 52 53 53 52
C	Fe	100 101 101 97 105	103 103 104 103 104	108 107 110 106 108	113 113 113 109 108
	Mn	139 138 140 139 140	115 116 116 117 116	97 99 100 99 99	102 100 100 101 102

$MgCl_2$ vol

		SAN-025	SAN-032	SAN-040	SAN-048
A	Cu	~~4 5 4 5 5~~	3 3 3 2 3	2 2 1 1 1	2 3 2 2 2
	Ag	3 3 3 4 4	4 3 3 3 3	3 3 3 3 3	5 5 4 5 4
	Co	3 3 2 3 2	10 10 10 9 9	10 10 10 10 10	10 10 10 10 9
	Pb	~~15 12 11 10 8~~	6 6 6 6 5	8 8 8 8 7	6 5 6 5 3
	ZN	13 12 12 12 13	6 6 5 5 5	5 5 5 4 4	
		8 7 6 7 7		~~6 7 6 6 6~~	5 5 5 4 4
		8 8 8 7 6			
B	Cu	56 57 57 58 57	~~58 59 58 58 58~~		
	Ag	~~61 61 61 61 61~~	57 57 57 57 56	53 55 53 54 53	55 55 56 54 55
	Co	71 73 72 73 72	71 72 73 72 70	70 70 71 70 71	71 72 71 72 72
	Pb	43 44 44 45 45	40 40 40 40 40	41 42 41 41 41	41 41 41 40 40
	ZN	~~32~~ 30 29 31 31	28 28 28 28 28	30 30 31 30 30	25 25 25 24 24
		125 125 124 127 126	124 121 ~~120~~ 121 123	120 119 120 120 119	
				~~124 126 126 126 125~~	121 120 120 120 120
C	Cu	~~117 118 116 116 117~~	~~110 110 111 110 110~~	105 107 ~~107 107~~ 105	106 105 105 105 105
		108 110 109 111 109	109 109 108 110 109		
	Ag	141 138 141 139 141	141 143 140 141 140	141 139 141 140 142	~~140 139 141 140 139~~
	Co	76 76 76 76 75	73 73 71 70 72	73 72 73 73 73	70 69 70 69 69
	Pb	54 54 54 52 55	52 52 51 51 51	54 55 54 55 54	45 48 45 46 47
	ZN	241 ~~238~~ 241 235 240	235 232 233 235 231	226 227 229 224 230 ~~236 236 235 235 235~~	226 229 227 225 224

NaOAc gre

		SAN025	SAN032	SAN040	SAN048
A	Cu	4 4 5 4 5	5 5 4 4 4	5 5 4 5 4	3 2 3 3 3
	Ag	2 2 2 2 2	1 1 1 1 1	2 1 2 1 2	2 2 2 2 2
	Co	20 21 20 20 20	11 12 12 11 12	2 3 3 3 3	~~3 3 3 2 3~~
	Pb	6 6 6 6 6	6 7 6 4 4	7 8 7 7 7	7 7 7 7 7
	Zn	20 20 20 20 21	25 25 25 24 25	5 3 3 3 4	7 7 7 7 7
				24 24 24 25 25	24 24 24 24 24
B	Cu	58 58 59 59 59	58 58 59 60 59	60 60 60 61 59	58 57 59 59 59
	Ag	61 62 60 60 61	58 59 58 60 60	63 63 62 64 62	63 62 62 63 62
	Co	53 53 54 54 54	46 46 46 46 46	41 42 41 42 42	40 40 40 39 40
	Pb	27 29 29 29 29	27 29 28 27 28	27 27 28 29 27	31 31 31 31 31
	Zn	141 141 143 141 141	144 145 145 146 146	146 145 146 147 145	147 147 149 145 144
C	Cu	114 115 112 113 113	114 115 113 114 112	117 117 116 117 116	116 116 115 114 117
	Ag	119 117 119 116 117	117 118 119 118 117	124 123 ~~118 119~~ 120 120 119	118 119 117 121 118
	Co	89 90 98 89 90	81 82 83 81 82	76 75 76 77 76	74 72 73 74 73
	Pb	54 54 54 55 54	51 53 52 52 49	51 52 52 52 52	57 57 56 58 58
	Zn	252 256 256 253 257	259 257 262 264 260	258 257 259 253 257	257 259 257 257 259

NH_2OH 6k

		SAW025	SAW032	SAW040	SAW048
A	Cu	5 7 7 7 7	3 4 3 4 3	2 2 3 3 3	1 2 2 2 2
	Ag	0 0 0 0 0	0 0 0 0 0	0 0 0 0 0	0 0 0 0 0
	Co	26 26 26 26 27	3 2 3 2 2	2 2 1 2 1	1 2 2 2 1
	Pb	5 5 5 5 5	5 5 5 5 5	5 5 5 5 5	5 5 4 4 4
	Zn	111 109 111 109 111	28 27 28 29 28	20 19 19 19 18	16 17 17 17 17
B	Cu	71 72 72 72 72	68 68 68 68 69	~~69 71 70 72 70~~ 69 69 69 70 69	67 66 67 66 67
	Ag	75 76 77 76 77	73 73 73 73 72	71 72 72 72 72	66 66 65 65 64
	Co	65 66 65 65 65	42 43 42 42 43	40 42 42 42 41	42 42 42 41 42
	Pb	34 33 32 34 34	34 33 32 33 34	33 33 34 33 33	32 32 32 32 32
	Zn	248 247 250 248 246	170 169 172 168 167	156 155 157 158 158	156 158 157 157 157
C	Cu	138 138 139 139 138	135 134 138 134 136	~~140 140 137 142 138~~ 137 135 135 135 135	132 131 133 132 132
	Ag	152 152 151 149 149	148 148 147 144 145	140 140 141 138 141	~~138~~ 133 129 129 129 129 129
	Co	106 105 107 106 106	84 85 83 82 83	82 82 83 82 82	82 81 80 81 81
	Pb	62 62 62 61 62	62 62 62 62 62	61 61 60 62 62	60 60 60 60 59
	Zn	371 373 374 371 373	302 306 307 297 298	283 287 283 286 286	284 290 286 286 289

$MgCl_2$ red

		SAN025	SAN032	SAN040	SAN048
A	Fe	1 0 0 0 0	0 0 1 0 0	3 2 0 1 3	1 2 3 0 0
	Mn	23 24 23 22 22	6 5 5 5 4	3 3 3 3 3	4 5 6 6 6
B	Fe	49 50 44 48 54	51 51 51 49 48	49 48 50 48 46	46 46 46 46 45
	Mn	73 74 73 74 74	58 56 56 56 57	55 55 55 54 54	59 56 55 56 58
C	Fe	95 93 92 95 93	95 96 92 92 93	97 92 93 97 99	96 95 94 95 ~~90~~
	Mn	123 125 125 123 123	108 107 108 107 109	105 105 106 107 108	109 108 109 110 109

NaOAc c[illegible]

~~NH_2OH~~ ~~[illegible]~~

		SAN025	SAN032	SAN040	SAN048
A	Fe	~~1 0 1 0 0~~ 5 3 5 0 4	5 5 4 7 2	9 ~~8 8 8~~ 7 7 7 6	12 11 15 10 10
	MN	25 26 25 24 24	11 11 12 13 11	7 8 8 6 7	7 8 8 9 9
B	Fe	43 44 40 44 42	41 37 42 42 41	49 46 45 49 47	59 58 56 58 58
	MN	75 74 77 77 75	64 64 63 63 63	60 60 58 60 58	60 62 61 61 58
C	Fe	84 89 83 88 85	83 82 83 83 83	90 92 92 89 90	95 99 98 94 97
	MN	127 125 126 127 127	115 116 118 115 115	111 110 111 109 109	111 111 108 109 110

NH_2OH 1w

~~NaOAc~~ ~~green~~

		SAN025	SAN032	SAN040	SAN048
A	Fe	~~3 4 5 3 3~~ 12 13 13 16 15	~~2 4 0 3 5~~ 23 21 22 22 23 19	~~9 5 6 10 8~~ 25 21 23 22 22 23	~~16 13 12 13 14~~ 22 20 23 21 21
	Mn	~~25 26 25 24 24~~ 39 39 39 39 39	~~14 14 14 14 14~~ ~~11 11 12 13 11~~ 2 3 4 3 4	~~7 8 8 6 7~~ 2 2 2 2 3	~~7 8 8 9 9~~ 3 3 2 3 2
B	Fe	~~43 46 44 46 44~~ 62 61 63 62 62	~~44 44 45 46 42~~ 68 69 70 70 68	~~48 54 51 47 50~~ 72 70 74 71 71	~~54 54 57 58 60~~ 69 71 70 69 71
	Mn	~~75 74 77 77 75~~ 92 92 92 93 92	~~64 64 63 63 63~~ 57 55 56 55 57	~~60 60 58 60 58~~ 55 56 56 56 55	~~60 62 61 61 58~~ 58 57 56 56 56
C	Fe	~~89 90 93 89 89~~ 109 114 113 111 110	~~86 88 88 88 86~~ 119 115 118 119 114	~~97 94 96 90 93~~ 122 122 119 117 119	~~102 104 99 102 102~~ 121 115 116 116 120
	Mn	~~127 125 126 127 127~~ 141 143 142 142 141	~~115 116 118 115 115~~ 105 105 107 105 107	~~111 110 111 109 109~~ 106 105 104 105 106	~~111 111 108 109 110~~ 105 107 107 107 107

$MgCl_2$ red

		SAN-021	SAN-028	SAN-036	SAN-044
A	Cu	4 4 3 3 3	3 5 4 4 4	4 4 3 4 4	~~2 3 2 3 3~~ ~~1 0 0 0~~
	Ag	5 4 4 4 4	4 4 4 4 4	4 4 4 4 4	5 5 4 4 4
	Co	10 10 11 10 11	9 9 9 9 9	13 13 14 13 12	11 10 11 10 10
	Pb	~~8 6 8 8 7~~ 8 8 9 8 9	7 8 9 8 8	9 11 10 11 9	8 8 7 8 7
	ZN	8 7 7 7 7	6 8 7 7 7	8 8 8 8 8	7 8 6 7 6
B	Cu	60 60 60 59 59	60 60 59 59 59	58 58 58 58 57 57	58 59 58 58 58
	Ag	79 79 79 78 78	78 77 77 77 77	79 78 78 78 78	78 78 78 78 78
	Co	45 46 45 45 46	42 42 44 44 42	47 46 47 47 47	44 44 43 44 43
	Pb	33 33 32 33 31	31 32 32 32 32	33 35 32 34 33	33 32 34 32 31
	ZN	129 130 128 128 129	128 127 127 127 127	128 129 129 128 130	128 128 127 127 126
C	Cu	114 114 114 114 113	114 112 112 113 113	113 112 110 112 110	112 112 112 113 113
	Ag	152 152 153 152 151	152 151 151 150 150	153 153 153 153 152	151 150 151 151 151
	Co	79 79 79 79 79	75 77 75 77 76	80 79 80 80 80	79 77 78 78 78
	Pb	56 55 54 54 55	55 55 54 55 55	57 57 58 59 58	56 58 57 57 56
	ZN	243 244 241 242 242	240 240 240 240 240	244 244 245 243 245	242 243 241 242 241

NaOAc green

		SAW-021	SAW-028	SAW-036	SAW-044
A	Cu	5 5 5 5 5	12 11 12 10 11	7 7 7 7 7	5 6 6 5 5 ~~7 8 8 8 8~~
	Ag	4 4 4 4 4	3 3 3 3 3	3 4 3 3 3	3 3 3 3 3
	Co	11 11 11 11 11	11 10 11 10 10	11 11 10 10 10	11 11 11 11 11
	Pb	8 8 7 7 8	8 7 9 8 8	7 7 7 7 6	8 7 8 8 8
	Zn	20 20 20 20 20	18 18 18 17 16	26 26 26 25 25	25 27 26 26 26
B	Cu	62 62 63 61 61	70 70 70 69 69	65 65 65 65 65	63 62 62 63 63 ~~67 67 66 67 68~~
	Ag	64 65 65 65 64	67 67 67 67 67	65 66 66 66 66	65 65 65 65 65
	Co	45 45 45 45 44	45 45 45 44 44	46 45 45 45 45	46 46 46 46 46
	Pb	31 32 30 32 31	34 33 33 33 35	33 31 32 34 31	33 34 33 34 33
	Zn	147 146 145 145 144	142 143 143 140 141	151 151 151 150 149	153 153 150 151 150
C	Cu	118 118 117 115 117	128 129 128 129 127	125 125 124 124 124	~~125 125 126 125 126~~ 120 119 119 120 118
	Ag	127 126 125 125 126	132 131 132 131 132	128 130 128 125 127	126 127 125 126 125
	Co	78 77 78 77 78	79 78 79 77 78	79 81 79 80 79	81 80 81 80 81
	Pb	56 56 58 56 56	59 59 61 60 61	60 60 60 59 59	60 58 60 58 62
	Zn	262 264 263 264 267	261 262 262 25 261	269 267 267 266 266	272 269 268 268 270

NH_2OH blue

		SAN-021	SAN-028	SAN-036	SAN-044
A	Cu	8 8 8 8 7	9 8 8 8 7	3 3 3 3 4	3 3 3 3 3
	Ag	0 0 0 0 0	0 0 0 0 0	0 0 0 1 0	0 0 0 0 1
	Co	19 19 19 18 18	6 7 6 6 6	5 5 5 5 6	5 4 5 5 4
	Pb	10 10 10 10 10	9 ~~8 8 8~~ 9 (9 9 9)	8 9 8 9 (9)	10 9 9 9 10
	Zn	91 90 90 90 90	58 58 57 57 57	28 28 29 28 28	25 26 26 26 25
B	Cu	80 79 82 81 80	75 76 75 75 75	71 70 70 70 72	71 71 69 71 70
	Ag	76 76 77 77 76	77 77 77 76 76	74 73 74 73 73	76 76 76 78 75
	Co	61 60 60 59 60	48 49 49 49 48	47 45 46 46 46	47 47 46 46 47
	Pb	40 41 40 41 39	~~37 38 38 38 36~~ (40 39 40 39 39)	37 39 39 39 37	39 39 38 39 38
	Zn	263 262 260 262 263	203 203 202 200 200	172 175 174 172 173	172 174 173 172 170
C	Cu	145 146 144 144 144	142 142 143 142 142	139 139 139 140 138	139 140 138 138 140
	Ag	157 158 159 157 156	157 158 160 158 158	153 151 151 149 148	150 150 148 149 150
	Co	101 101 101 101 101	89 90 89 89 88	88 88 88 88 87	90 89 89 89 90
	Pb	69 68 70 68 69	~~67 66 66 66 66~~ (70 70 71 71 71)	69 68 68 70 67	71 70 70 70 70
	Zn	370 370 367 369 365	336 339 337 339 339	314 311 313 311 312	307 310 309 309 310

MgCl2 red

		SAN021	SAN028	SAN036	SAN044
A	Fe	3 3 3 2 4	2 2 1 0 0	2 0 3 1 0 ~~0 0 0 0 0~~	3 1 2 1 0 ~~4 5 5 5 4~~
	Mn	7 8 7 6 7	5 4 5 5 5	6 4 5 5 5	6 0 6 6 0 6 5
B	Fe	52 51 53 54 54	50 49 47 50 48	47 46 48 48 46	55 54 55 53 53
	Mn	58 55 57 57 56	56 56 54 54 53	56 55 57 58 57	60 62 62 60 61
C	Fe	102 100 101 99 100	100 97 99 99 97	97 94 95 93 93	100 99 ~~98 95 95~~ 104 103 101
	Mn	106 105 106 105 106	103 103 101 102 102	107 107 109 110 107	114 114 113 114 114

NaOAc gren

		SAN021	SAN028	SAN036	SAN044
A	Fe	0 0 1 0 1	0 0 1 0 1 0	3 3 3 2 3	4 5 6 3 4
	Mn	17 19 19 18 18	21 21 22 21 21	10 11 11 10 11	10 8 9 10 8
B	Fe	40 39 40 39 38	37 36 37 39 ~~35~~ 40	32 28 30 27 28	38 42 38 39 41
	Mn	71 70 71 71 70	74 74 75 75 76	62 64 62 62 62	60 60 59 61 62
C	Fe	82 83 82 81 80	78 78 ~~81~~ 80 79 80	72 71 72 70 72	88 91 90 90 90
	Mn	122 123 124 125 123	127 128 126 127 127	112 114 114 113 112	110 107 111 111 110

NH_2OH blue

		SAN021	SAN028	SAW036	SAW044
A	Fe	15 17 16 14 14	33 34 30 28 29	30 29 29 30 30	18 18 19 21 19
	Mn	44 43 43 43 43	18 18 18 17 17	~~5 5 6 5 5~~ 76 7 7 7	~~5~~ 5 5 5 5
B	Fe	~~56~~ 61 61 61 60 59	81 80 78 78 76	80 80 80 81 81 59 59 59 59	71 71 71 72 72
	Mn	91 90 91 91 90	69 69 68 68 69	58 ~~58 58 58 58~~	60 60 61 60 61
C	Fe	109 108 108 ~~109~~ 108	127 127 126 124 124	126 127 127 130 127 110 109 107 111 111	120 123 121 121 121
	Mn	143 144 144 146 144	119 119 118 120 117	~~105 106 108 106 108~~	112 113 112 111 110

$MgCl_2$ red

		SAN-026	SAN-035	SAN043	SAN051
A	Cu	6 6 6 6 6	5 6 5 6 5	6 6 5 5 5	5 5 5 5 4
	Ag	6 6 5 5 5	6 6 6 5 5	5 5 5 5 5	5 6 6 6 6
	Co	15 14 16 16 16	17 18 18 17 18	19 20 20 20 18	12 12 12 12 12
	Pb	~~6 8 6 5 8 9~~ 7 8 11 7 9 10	~~12 11 8 11 14~~ 11 12 13 11 11	10 14 13 10 10	12 11 12 12 10
	Zn	14 12 14 14 14	14 16 13 14 11	16 16 12 13 13	12 16 12 13 16 ~~9 9 7 7 7~~
B	Cu	64 64 64 64 63	63 64 63 62 63	63 64 63 62 62	63 64 63 63 63
	Ag	80 80 80 79 79	82 83 81 81 81	79 79 79 79 79	81 81 80 80 80
	Co	51 53 52 53 52	55 54 54 54 54	55 56 56 56 55	47 48 48 48 48
	Pb	~~28 29 29 27 27~~ 33 33 31 32 32	35 37 33 36 35 ~~33 34 30 30 32~~	35 35 34 35 35	37 36 35 34 36
	Zn	136 139 138 136 140	149 152 148 149 149	137 137 136 137 140	155 155 154 154 158 ~~149 148 146 143 146~~
C	Cu	121 121 120 119 119	120 121 119 119 120	120 118 120 120 120	119 119 120 119 118
	Ag	155 154 153 154 155	158 158 159 157 157	157 157 155 158 157	157 157 156 158 157
	Co	87 88 87 87 87	91 91 91 92 89	95 93 95 94 92	83 85 82 84 83
	Pb	~~51 53 52 51 51~~ 56 57 59 57 56	~~55 57 56 54 58~~ 59 60 58 59 55	61 62 62 62 62	62 60 59 60 59
	Zn	255 258 253 254 253	253 255 255 258 253	253 253 252 255 251	254 258 256 256 253 ~~248 245 246 243 2~~

NaOAc gm

		SAN-026	SAN035	SAN043	SAN051
A	Cu	7 8 7 7 7	7 7 7 7 7	6 6 5 5 5	9 9 9 9 9 ~~10 10 10 10 10~~
	Ag	~~5~~ 5 5 5 5	4 4 4 4 4	4 4 4 3 3	5 5 5 5 4
	Co	18 18 19 17 17	21 21 21 22 20	18 18 18 18 18	12 13 11 12 13
	Pb	12 12 12 13 13 ~~10 10 10 12~~ 12	13 13 13 12 11	11 12 12 12 13	11 12 11 12 12
	ZN	56 56 56 55 54	99 97 101 98 97	39 42 42 42 39	30 31 31 31 32
B	Cu	69 69 69 69 69	67 68 67 66 ~~69~~	65 66 66 67 65	74 74 73 73 74
	Ag	60 60 60 60 60	59 59 58 57 58	62 61 62 63 64	65 66 65 65 65
	Co	55 56 54 54 55	58 58 57 58 58	55 55 56 55 56	50 50 50 49 50
	Pb	36 35 35 35 35	38 38 35 ~~40~~ ~~37~~	38 38 37 39 37	36 37 37 36 36
	ZN	188 185 184 185 184	233 233 233 232 234	174 173 172 173 173	172 171 173 170 170
C	Cu	127 127 127 127 127	127 127 126 126 127	127 126 126 126 126	130 131 132 130 130
	Ag	118 117 118 118 120	107 108 108 108 108	114 118 119 117 117	119 120 119 119 118
	Co	92 92 92 93 91	95 95 95 95 95	92 92 92 92 91	87 87 86 86 87
	Pb	62 63 60 61 61	63 64 65 65 65	63 62 62 65 64	64 63 64 63 63
	ZN	308 308 307 305 304	352 347 343 346 344	294 297 297 293 294	289 288 287 293 288

NH_2OH blue

		SAN 026	SAN035	SAN043	SAN051
A	Cu	5 5 4 4 4	3 3 3 4 3	3 2 2 2 2	11 12 12 12 12
	Ag	2 2 2 2 2	1 0 0 0 0	0 0 0 0 0	1 1 1 1 1
	Co	8 8 8 8 9	9 10 9 10 10	7 8 8 8 7	10 10 10 10 9
	Pb	16 13 15 14 14	13 11 13 13 10	14 16 15 14 16	14 13 15 15 15
	ZN	94 94 94 95 92	106 105 102 104 102	33 35 33 33 35	84 80 86 81 80
B	Cu	78 78 78 78 78	79 78 77 77 77	74 75 73 75 74	86 86 86 86 86
	Ag	81 80 80 80 80	80 79 79 80 79	80 79 79 79 80	83 82 82 82 82
	Co	54 54 54 53 52	56 57 57 56 55	54 53 54 54 54	55 56 56 55 54
	Pb	43 45 44 47 43	43 44 42 44 44	47 48 46 45 45	44 44 44 42 46
	ZN	244 248 244 248 246	260 257 255 258 260	193 193 190 191 191	265 266 262 264 264
C	Cu	146 146 148 146 145	148 145 146 146 145	144 143 144 145 143	153 152 153 153 153
	Ag	156 153 155 157 154	150 148 150 149 150	152 151 150 152 152	157 158 157 157 157
	Co	99 99 99 99 99	101 101 102 100 102	99 99 99 97 98	103 103 101 102 102
	Pb	76 76 76 77 77	76 76 75 74 74	76 77 78 80 76	77 76 77 79 76
	ZN	380 381 379 378 380	399 396 391 397 395	330 331 328 330 331	380 378 376 379 376

MgCl2 ND

		SAN026	SAN035	SAN043	SAN051
A	Fe	10300	04314	32412	10213
	Mn	22201	24443	44555	55466
B	Fe	43 45 44 46 44	45 46 47 49 48	49 48 50 47 48	45 48 44 47 44
	Mn	47 47 48 46 46	51 49 47 50 49	49 51 50 49 49	49 51 48 48 49
C	Fe	93 92 92 91 89	93 88 92 94 91	95 93 92 94 95	92 94 92 89 93
	Mn	93 93 93 92 94	94 94 95 94 93	94 93 96 94 94	93 92 94 92 93

.0026
.047
.0916

NaOAc

		SAN026	SAN035	SAN043	SAN051
A	Fe	6 3 3 4 3	2 3 21 22 22 23	20 20 20 20 18	2 4 3 3 3
	MW	15 12 13 13 14	11 11 12 12 10	7 7 7 7 7	9 9 9 9 9
B	Fe	45 46 47 46 48	67 66 68 68 66	61 62 64 61 62	40 41 42 40 38
	MW	59 59 59 59 59	57 59 57 56 57	52 51 53 55 54	56 56 56 55 56
C	Fe	88 89 88 89 87	111 113 110 112 111	111 108 108 109 106	76 77 77 77 76
	MW	105 102 103 104 104	102 101 101 102 103	100 99 100 97 97	99 100 100 100 99

NH_2OH [illegible]

		SAN026	SAN035	SAN043	SAN051
A	Fe	28 29 29 29 29	36 39 38 38 39	20 20 20 20 18	24 27 25 22 21
	Mn	7 7 7 7 7	5 6 5 4 5	5 4 2 3 4	12 12 12 11 11
B	Fe	70 75 73 73 76	82 80 80 81 81	64 65 66 64 68	64 66 68 68 69
	Mn	54 56 55 56 55	52 52 52 52 52	51 52 52 52 52	58 61 61 58 60
C	Fe	118 119 119 115 117	125 122 125 129 126	109 108 108 107 109	110 113 111 109 112
	Mn	99 98 99 99 101	99 98 95 98 96	96 98 95 96 96	105 105 105 106 106

$MgCl_2$ red

		SAN042	SAN 050	SAN-052	A	B
A	Cu	5 5 4 5 5	4 5 4 5 5	5 5 5 5 4	10 10 10 10 10	7 8 7 8 7
	Ag	4 4 4 4 4	4 4 4 4 4	4 4 4 4 4	11 11 11 11 11	7 7 7 7 7
	Co	15 15 15 15 14	16 15 15 15 14	16 16 16 16 15	10 10 10 10 10	7 7 7 8 7
	Pb	9 8 7 8 6	9 8 8 8 8	8 9 7 7 5	11 11 11 10 11	8 8 8 8 7
	Zn	10 11 9 8 9	15 14 14 12 14	11 14 14 11 12	40 41 44 39 40	24 23 25 26 23
B	Cu	64 65 63 63 63	62 62 62 61 62	64 64 64 63 63	69 69 68 69 69	66 65 66 65 65
	Ag	81 81 81 81 81	81 81 81 82 82	81 81 81 81 81	87 87 88 87 88	84 84 84 81 83
	Co	50 52 50 51 51	52 53 52 51 52	53 54 53 53 52	48 46 46 47 46	45 46 45 46 45
	Pb	30 31 29 30 29	32 31 34 33 31	34 33 32 34 32	36 ~~37~~ 36 36 37 37	34 34 32 33 32
	Zn	151 149 149 149 150	144 146 143 147 146	146 145 145 148 145	177 176 178 176 176	153 154 154 154 153
C	Cu	121 122 119 120 120	119 118 119 119 119	121 121 121 120 122	127 126 126 126 126	124 124 124 123 124
	Ag	158 158 157 157 158	159 159 158 159 158	158 158 157 157 156	166 165 166 166 164	160 162 162 162 161
	Co	8 8 8 8 8 8 8 8 8	89 88 88 88 88	90 90 91 89 88	83 84 83 83 83	84 83 84 82 83
	Pb	56 56 55 55 54	58 56 57 57 56	58 59 59 57 59	63 64 65 64 65	61 59 57 60 59
	Zn	268 271 269 267 267	279 282 279 279 281	273 275 272 272 269	296 292 294 295 294	272 273 278 275 275

NaOAc gum

		SAN042	SAN050	SAN052	A	B
	Cu	9 9 10 10 10	9 10 10 10 10	9 9 8 9 8	8 8 8 9 9	7 7 8 8 7 7
A	Ag	4 4 4 4 4	4 4 4 4 4	4 4 4 4 4	12 12 12 12 12	8 8 8 8 8
	Co	16 16 15 15 16	12 12 12 12 13	16 16 16 16 16	10 11 9 10 10	9 9 9 9 9
	Pb	9 10 9 11 9	10 9 8 8 10	10 10 10 8 9	12 11 10 10 12	9 7 9 8 8
	ZN	32 31 31 31 32	32 33 34 31 30	33 31 32 33 32	42 43 43 43 43	30 30 30 30 30
B	Cu	73 73 73 74 72	72 72 71 71 72	69 70 70 71 69	71 71 70 70 70	69 69 68 69 70
	Ag	70 70 70 70 71	70 70 71 72 71	71 70 71 71 71	92 92 93 92 93	87 88 87 87 87
	Co	55 54 55 55 54	51 51 51 52 52	53 54 55 53 55	49 49 50 49 49	48 48 48 48 48
	Pb	38 36 37 38 37	35 38 36 38 36	36 34 36 35 35	36 35 37 36 37	34 34 35 35 34
	ZN	170 168 173 172 170	172 171 173 172 170	172 171 173 170 172	182 185 183 182 183	169 171 170 169 170
C	Cu	134 136 135 135 135	134 134 132 133 133	134 137 132 134 134	132 131 132 133 133	130 130 130 130 131
	Ag	133 134 135 132 133	132 132 134 133 134	136 137 135 136 135	163 163 163 164 162	161 161 160 159 160
	Co	93 93 93 93 93	91 91 91 90 91	93 93 93 92 93	87 88 87 88 88	87 87 87 87 86
	Pb	63 64 64 62 64	64 63 64 63 65	65 63 63 64 64	63 64 65 63 63	59 62 62 62 63
	ZN	301 301 303 303 301	303 301 302 299 298	300 304 303 303 304	312 315 309 312 309	298 300 301 299 300

NH_2OH values

		SAN042	SAN050	SAN052	A	B
A	Cu	8 8 8 8 9	5 4 4 4 4	7 7 7 7 6	9 8 8 9 8	5 5 5 4 4
	Ag	0 0 0 0 0	0 0 0 0 0	0 0 0 0 0	8 8 8 8 8	5 4 4 5 5
	Co	10 11 10 11 10	4 3 4 4 4	6 6 7 7 5	8 8 8 8 8	4 5 5 5 5
	Pb	8 8 9 8 9	9 8 11 11 9	9 7 9 9 8	11 11 12 10 11	8 9 10 8 8
	Zn	68 71 73 72 72	28 27 29 28 28	36 38 36 38 38	45 44 46 44 45	32 29 31 29 30
B	Cu	81 82 82 82 82	79 79 78 78 78	80 81 82 81 83	81 82 82 82 82	77 75 76 76 76
	Ag	82 82 82 83 82	82 81 81 82 81	80 82 81 80 80	90 88 88 88 88	84 85 84 84 84
	Co	57 56 56 56 57	50 50 49 49 50	51 50 50 51 52	~~50 51~~ 53 52 52 53 54	48 50 50 50 50
	Pb	39 39 40 38 40	42 43 43 43 43	42 45 40 42 42	43 43 43 44 42	39 41 39 41 38
	Zn	227 229 229 230 229	192 194 193 192 192	198 197 197 199 198	207 208 207 207 208	189 190 191 192 191
C	Cu	154 155 155 154 153	151 152 150 151 152	153 155 153 151 152	156 155 155 155 155	149 148 148 147 147
	Ag	163 163 162 162 161	163 161 162 161 162	159 161 160 159 160	168 168 168 168 169	161 162 162 161 161
	Co	101 102 102 101 102	95 96 95 95 95	95 96 97 97 96	~~94 94 94 94 94~~ 97 97 98 97 98	94 94 93 93 93
	Pb	70 71 72 74 73	76 78 77 76 76	76 74 75 75 75	75 77 76 77 78	72 71 74 71 71
	Zn	379 374 374 377 376	338 339 343 343 340	350 348 344 347 348	360 362 363 357 356	337 340 336 335 337

$MgCr_2$ ND

		SAN042	SAN050	SAN052	A	B
A	Fe	2 4 2 3 2	2 3 1 1 1	1 1 1 1 1	6 6 7 6 8	3 3 3 3 3
	MN	4 5 4 4 4	6 6 5 5 5	3 5 3 2 3	12 11 12 13 11	5 5 6 7 5
B	Fe	5 8 5 7 5 7 5 5 5 4	5 6 5 6 5 6 5 6 5 6	5 3 5 4 5 5 5 4 5 5	6 3 6 2 6 1 6 2 6 2	5 9 5 7 5 8 5 7 5 9
	MN	6 2 6 3 6 1 6 0 4 0	5 9 5 9 5 9 5 9 6 1	5 8 5 8 5 7 5 7 5 6	6 6 6 6 6 4 6 4 6 5	6 0 6 2 6 0 6 1 6 1
C	Fe	111 110 111 111 111	108 108 111 111 110	107 110 108 110 106	117 115 116 116 116	113 112 112 113 112
	MN	115 114 114 114 116	110 108 109 110 109	110 110 109 109 111	115 117 116 117 117	112 112 111 114 111

NaOAc gm

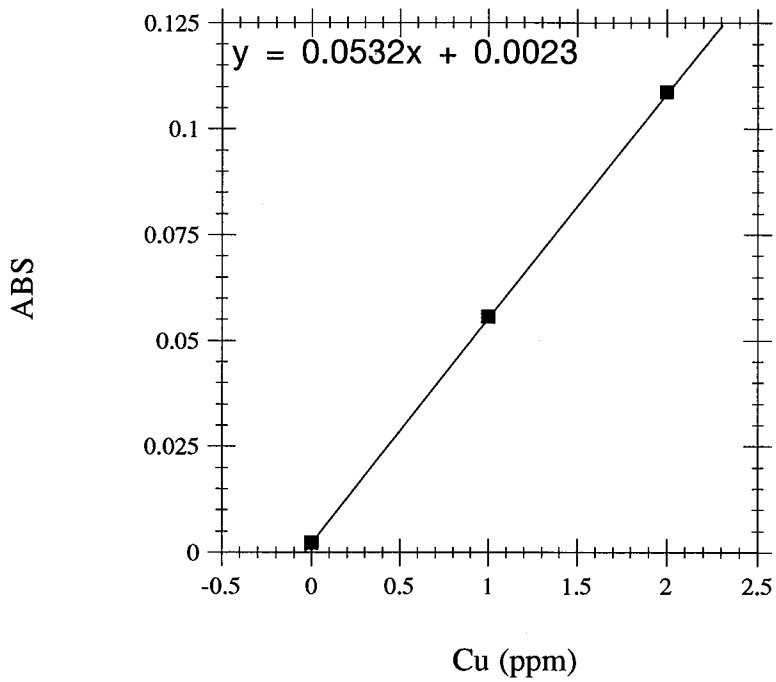
		SAN042	SAN050	SAN052	A	B
A	Fe	8 7 6 8 6	17 16 16 17 18	14 13 15 16 15	5 5 4 6 3	2 2 4 4 3
	Mn	11 11 11 11 12	9 7 8 8 8	9 10 10 10 9	11 11 11 11 12	5 7 6 6 6
B	Fe	58 60 61 60 58	70 69 70 70 70	67 65 68 67 67	53 53 56 54 56	55 58 57 60 56
	Mn	65 66 67 67 65	66 64 65 64 65	64 65 66 66 66	66 66 65 65 65	64 64 63 63 65
C	Fe	106 108 108 107 108	125 124 123 124 122	119 120 119 120 118	103 104 101 103 103	108 110 107 106 107
	Mn	118 116 119 117 118	119 118 120 119 119	117 119 118 118 119	120 119 121 121 120	118 118 118 121 118

NH_2OH brine

		SAN042	SAN050	SAN052	A	B
A	Fe	4 9 4 9 4 9 4 7 4 8	2 7 2 6 2 6 2 4 2 7	4 2 4 4 4 3 4 3 4 2	3 2 3 3 3	1 3 2 1 2
	Mn	~~1 1 1 1 1 1 0 1 1~~ 7 7 7 7 8	4 3 3 3 3	3 3 2 3 3	4 4 5 4 4	2 2 2 2 2
B	Fe	100 101 101 101 100	81 81 83 83 82	99 97 98 96 96	56 55 56 55 54	53 51 52 53 53
	Mn	~~65 64 70 69 72~~ 65 63 63	60 60 59 60 60	59 61 61 60 61	61 61 61 60 61	58 57 54 56 56
C	Fe	156 153 154 155 154	134 133 135 137 137	151 149 149 150 149	107 109 105 106 107	104 103 106 102 105
	Mn	~~128 127 127 128 127~~ 120 119 119 121 119	113 113 113 113 113	117 114 117 116 114	115 114 114 115 116	111 112 113 110 111

Cu data

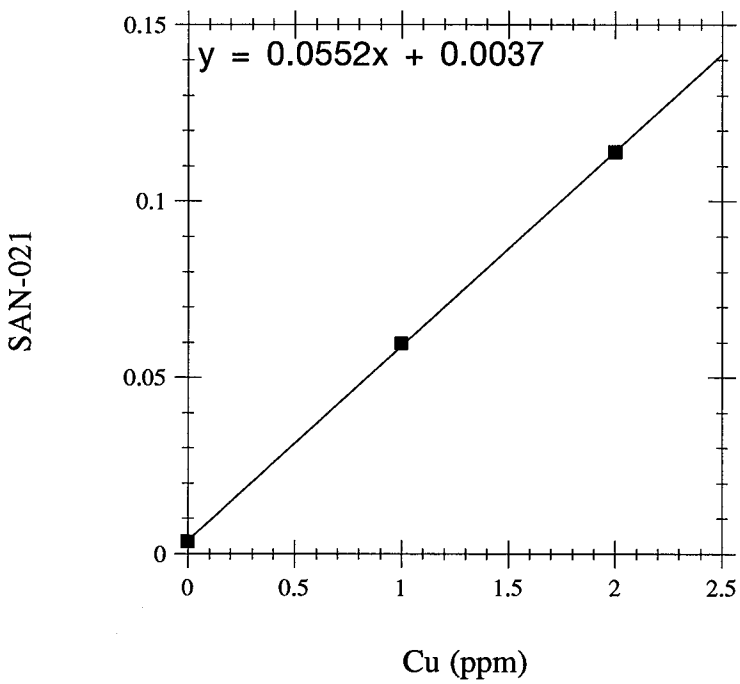
SAN-022 MgCl2



.0432 x 2 = .0864

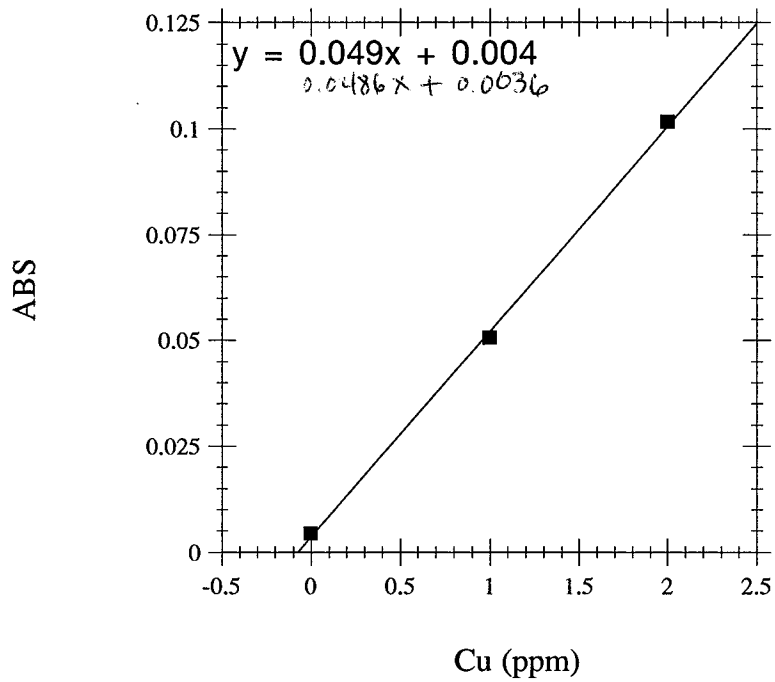
.0864 x $\frac{8\ ml}{1.6218\ g}$ = .676 ppm

SAN-021 MgCl2



.0670 x 2 = .134 x 8/1.016 = 1.055 ppm

SAN-023 MgCl2



~~.082~~
~~x2 = .164~~

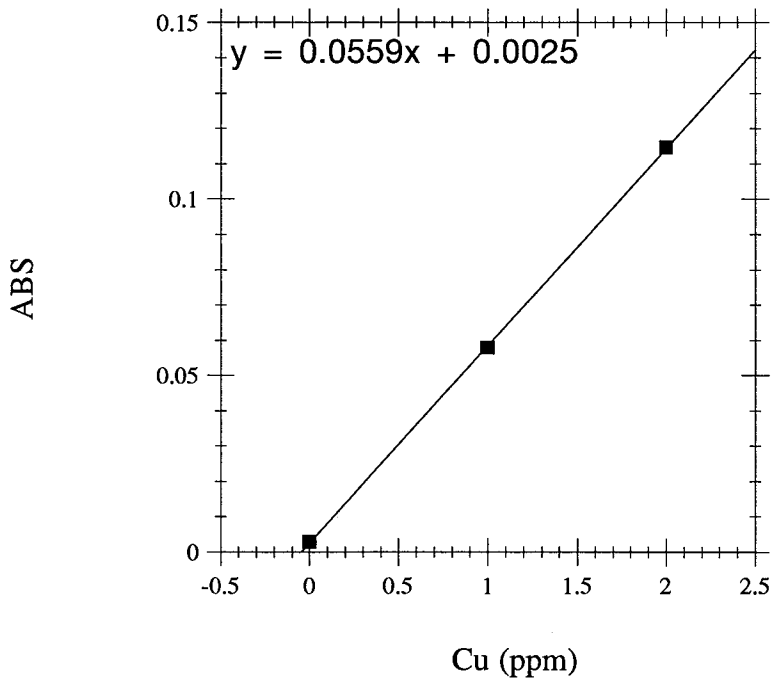
~~.164 x 8/1.022 =~~

~~1.284 ppm~~

.0741
x2 = .1482

.1482 x 8/1.022 = 1.16 ppm

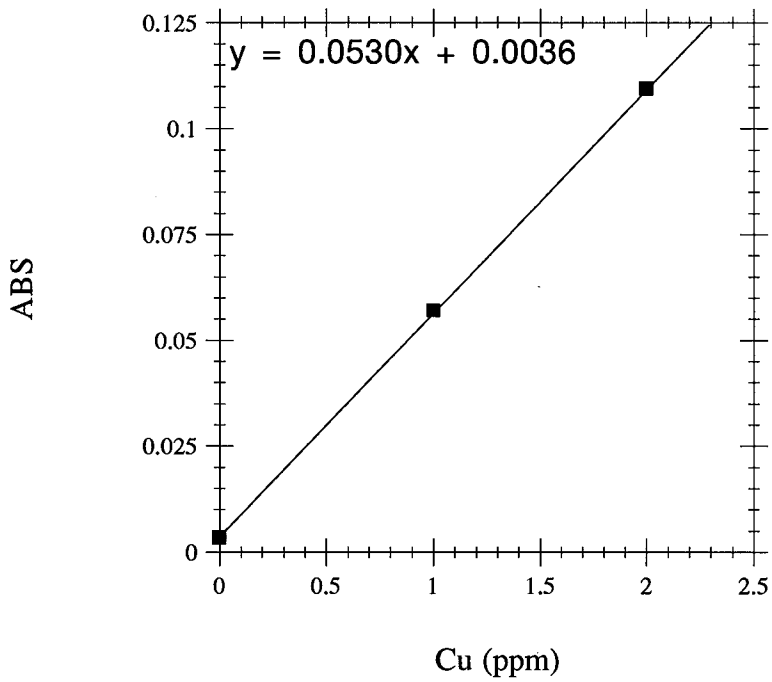
SAN-024 MgCl2



.0447 x 2 = .0894

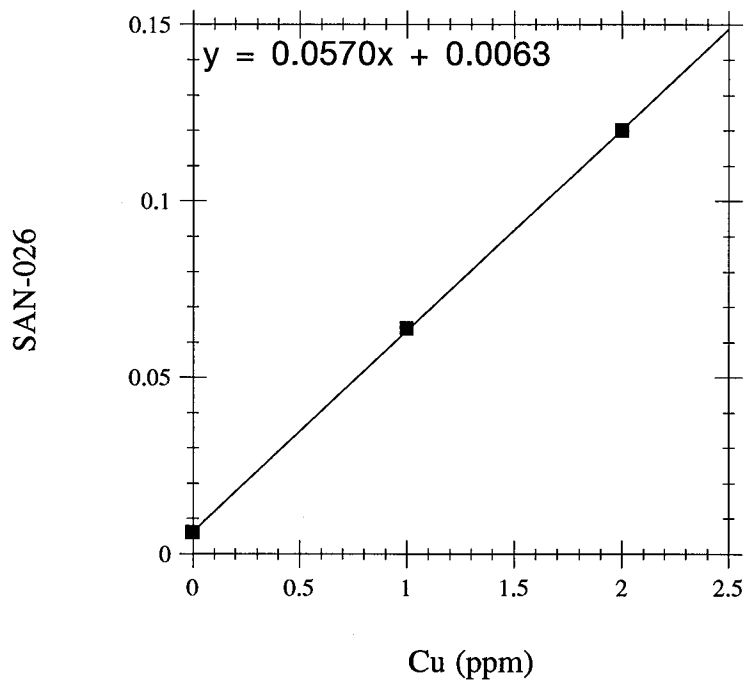
.0894 x 8 / 1.0183 = .702 ppm

SAN-025 MgCl2



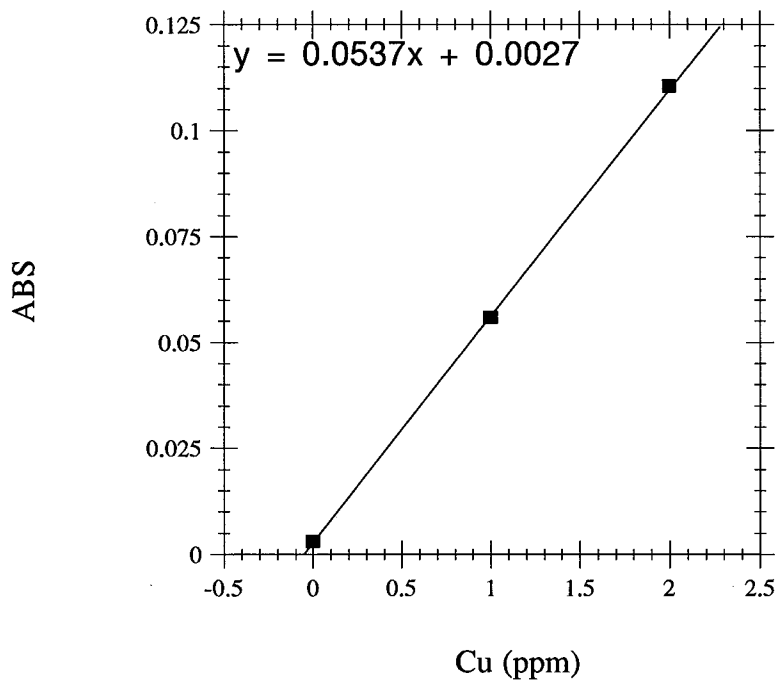
$.0679 \times 2 = .1358 \times \frac{8}{1.025} = 1.06$ ppm

SAN-026 MgCl2



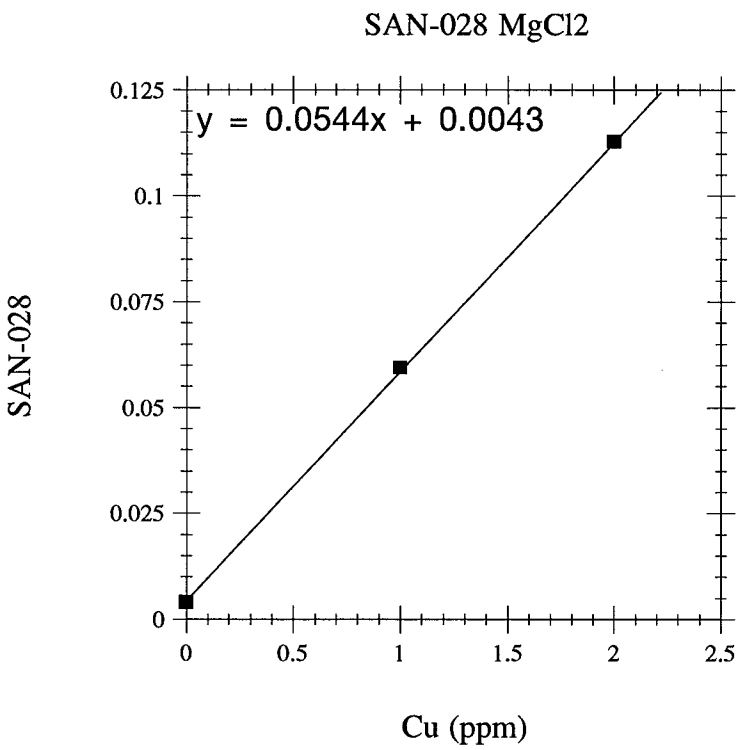
$.1105 \times 2 = .221 \times \frac{8}{1.021} = 1.732$ ppm

SAN-027 MgCl2



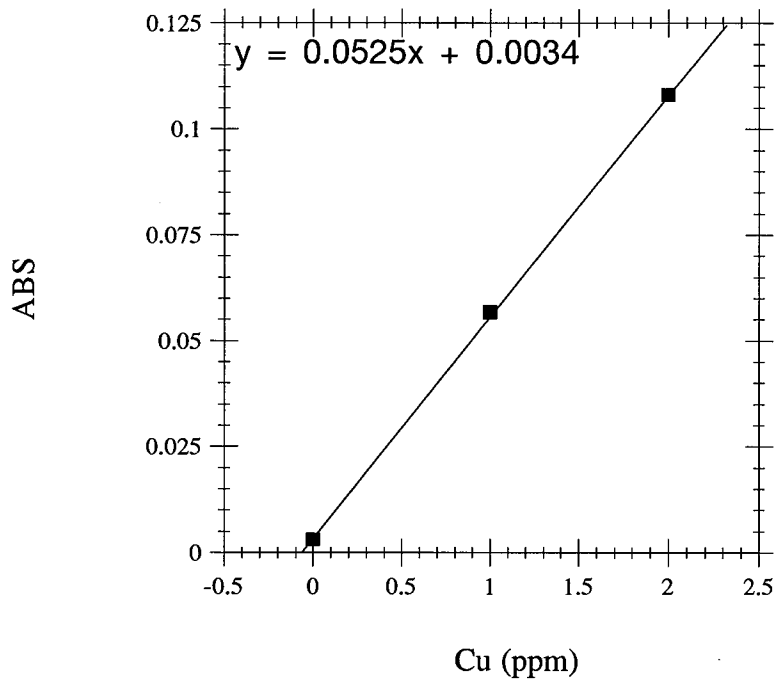
.6503 x 2 = .1006

.1006 x 8/1.013 = .794 ppm



.079 x 2 = .158 x 8 / 1.023 = 1.236 ppm

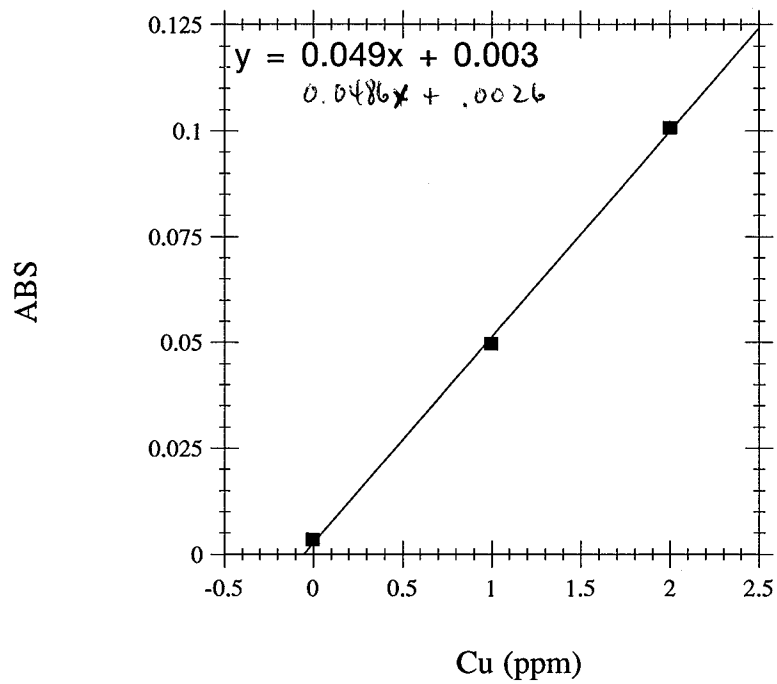
SAN-029 MgCl2



~~.04~~ .0648 x 2 = .1296

.1296 x ~~2~~ 1.0205 = 1.016 ppm

SAN-030 MgCl2



~~.061~~

~~x2 = .122~~

~~.122 x 8g soln / 1.022 g solid =~~

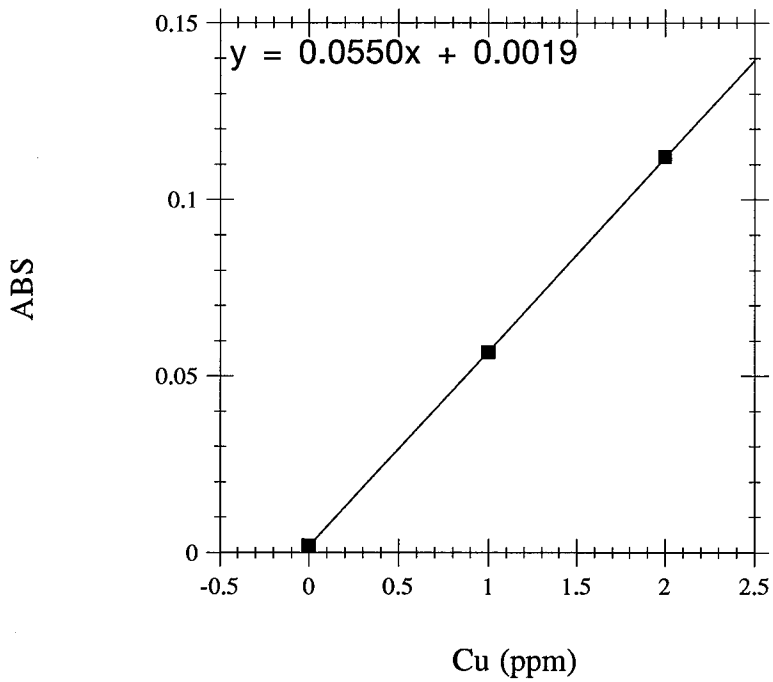
~~.955 ppm~~

.0535

x2 = .107

.107 x 8/1.022 = .837 ppm

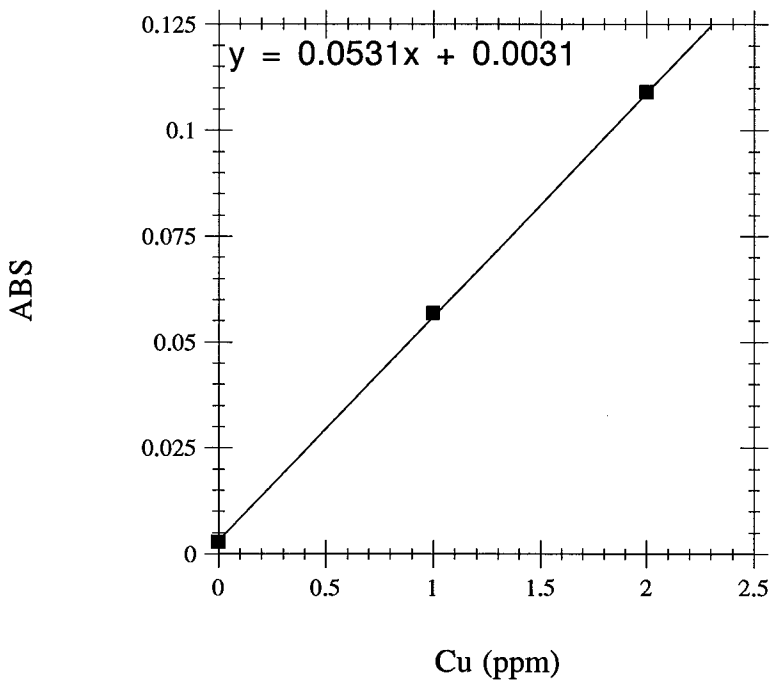
SAN-031 MgCl2



.0345 x 2 = .069

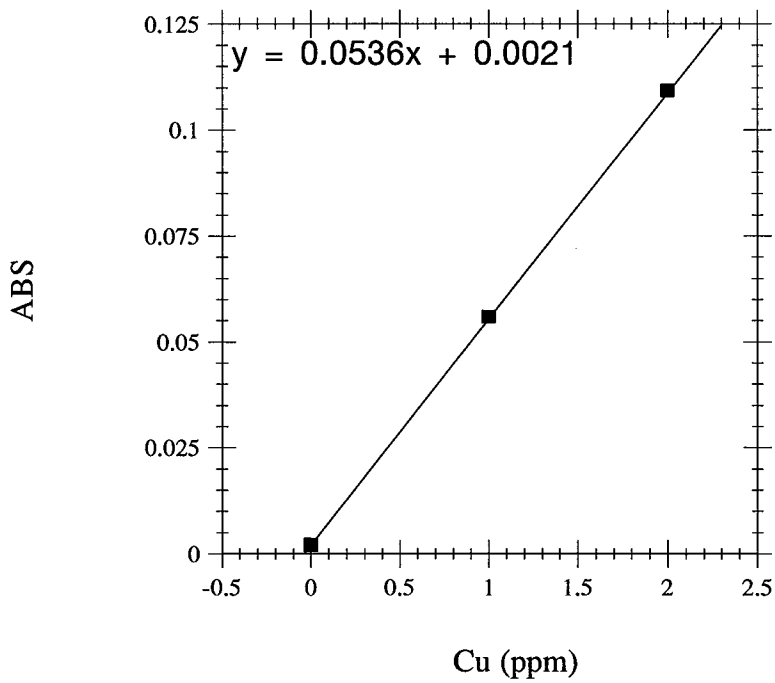
.069 x 8/1.0258 = .538 ppm

SAN-032 MgCl2



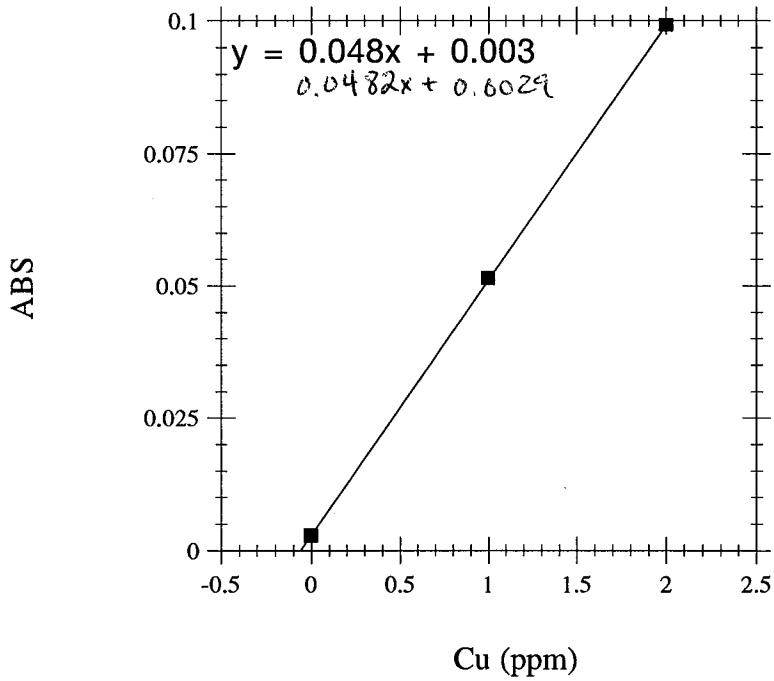
$.0584 \times 2 = .1168 \times \frac{8}{1.017} = .919\ ppm$

SAN-033 MgCl2



$.0392 \times 2 = .0784 \times \frac{8}{1.012} = .6197$ ppm

SAN-034 MgCl2

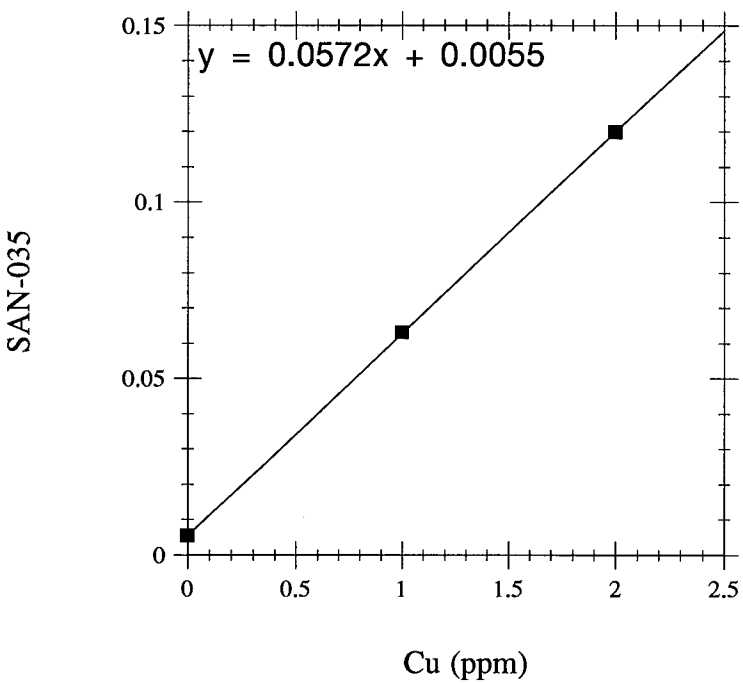


.060

x2 = .120

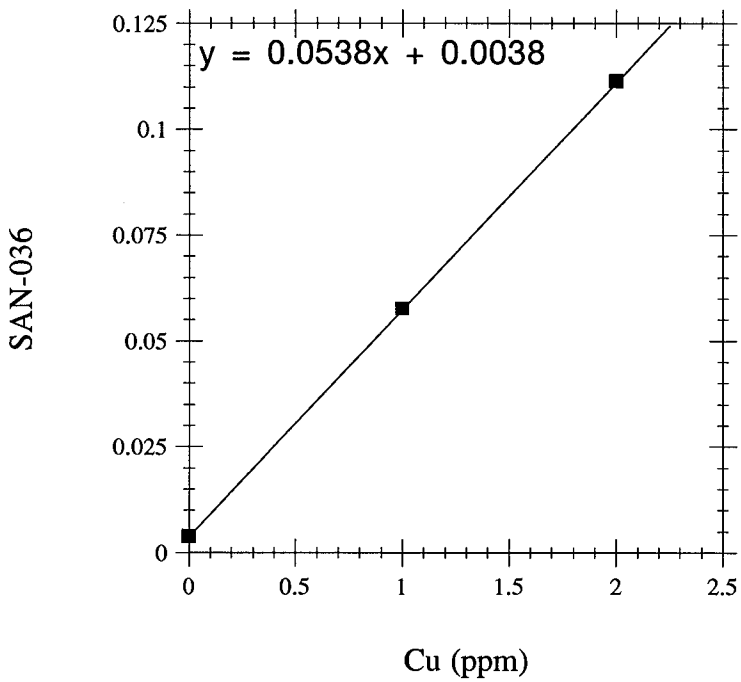
$.120 \times \frac{8}{1.009} = .951$ ppm

SAN-035 MgCl2



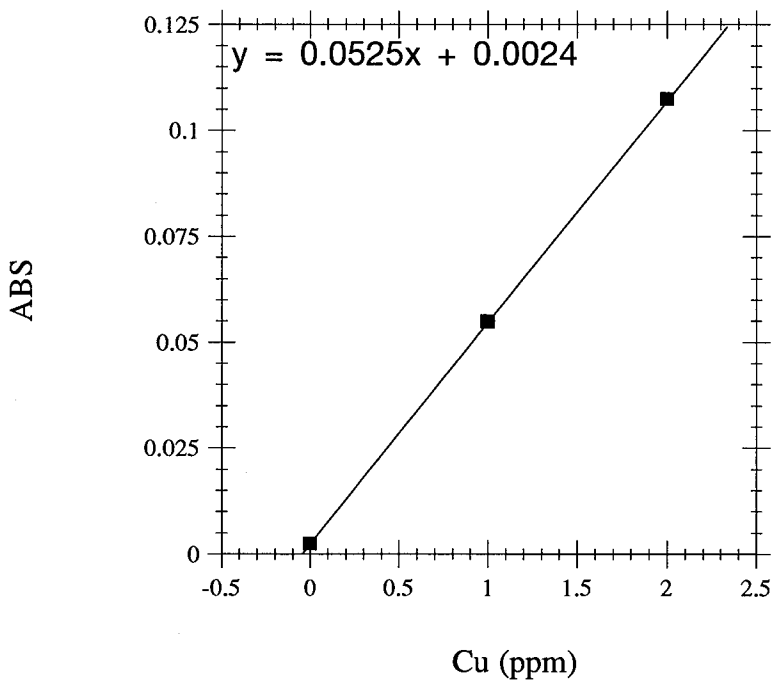
$.0961 \times 2 = .1922 \times \frac{8}{1.02} = 1.507 ppm$

SAN-036 MgCl2



$.0706 \times 2 = .1412 \times \frac{8}{1.014} = 1.114$ ppm

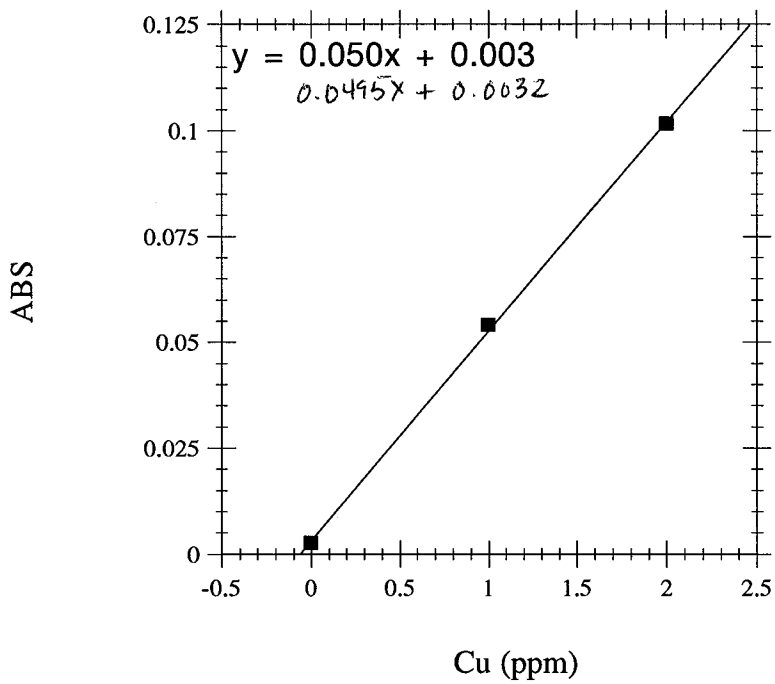
SAN-037 MgCl2



.0457 x 2 = .0914

.0914 x 8/1.0212 = .716 ppm

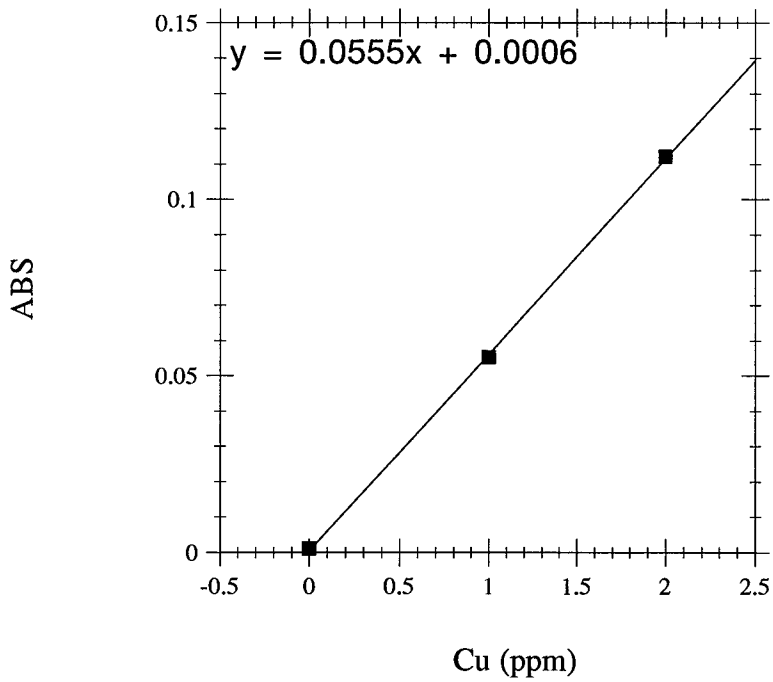
SAN-038 MgCl2



.0646
x2 = .1292

$.1292 \times \frac{8}{1.024} = 1.009$ ppm

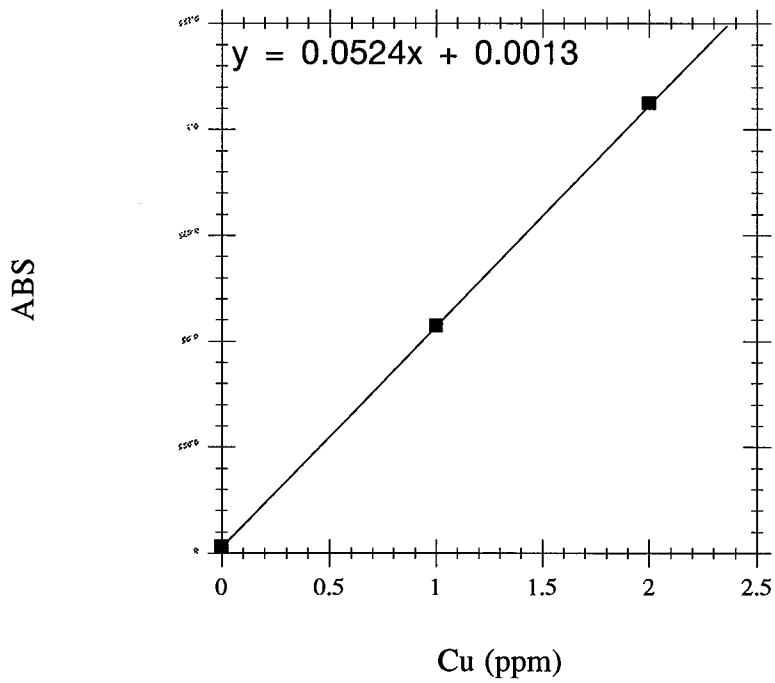
SAN-039 MgCl2



.0108 x 2 = .0216

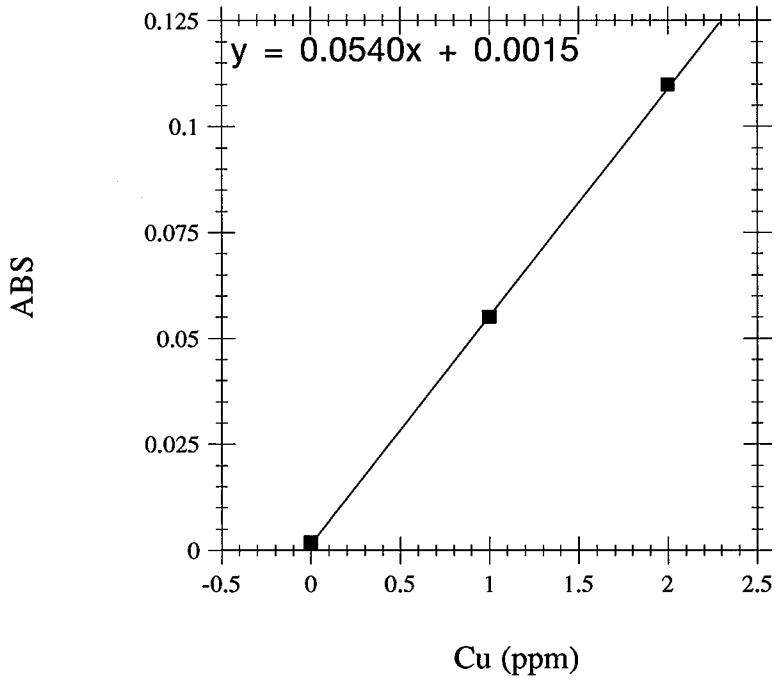
.0216 x 8/1.018 = .169 ppm

SAN-040 MgCl2



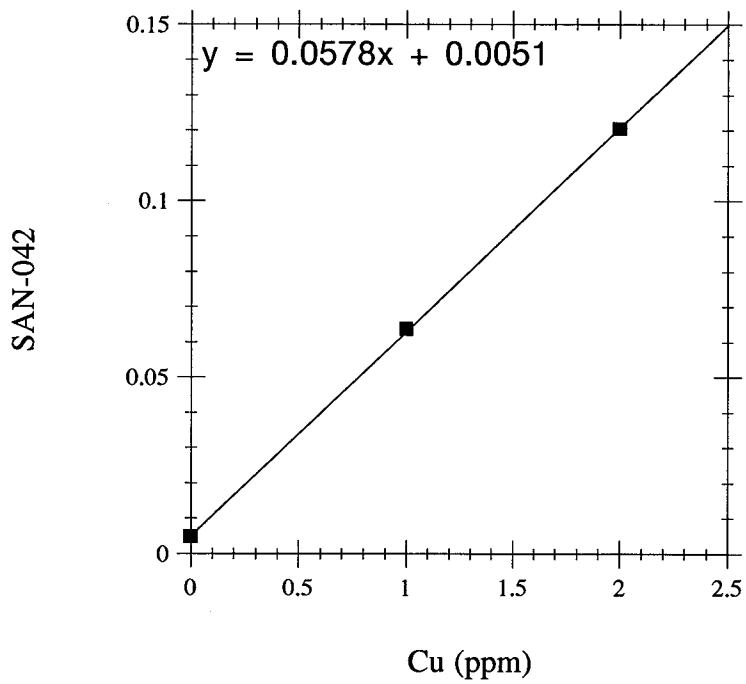
.6248 x 2 = .0496 x 8 / 1.017 = .390 ppm

SAN-041 MgCl2



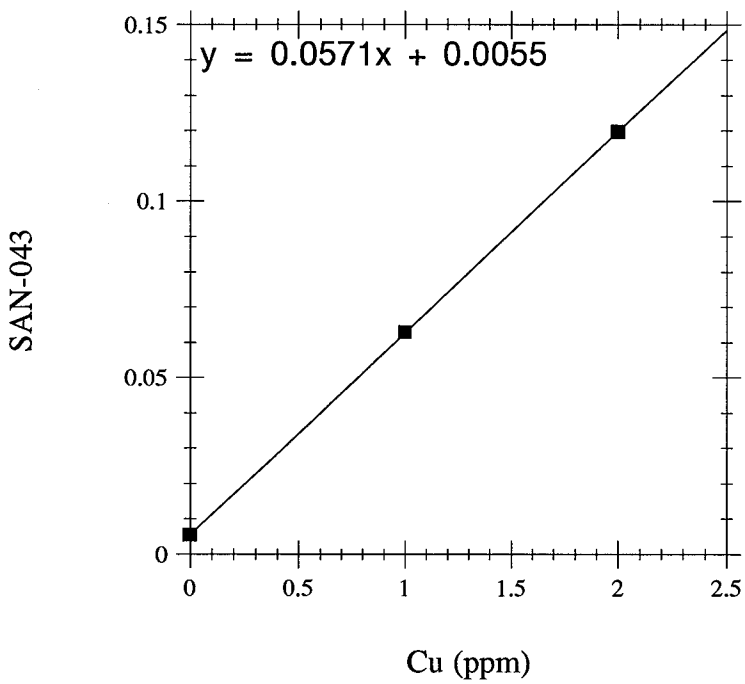
$.0278 \times 2 = .0556 \times \frac{8}{1.015} = .438$ ppm

SAN-042 MgCl2



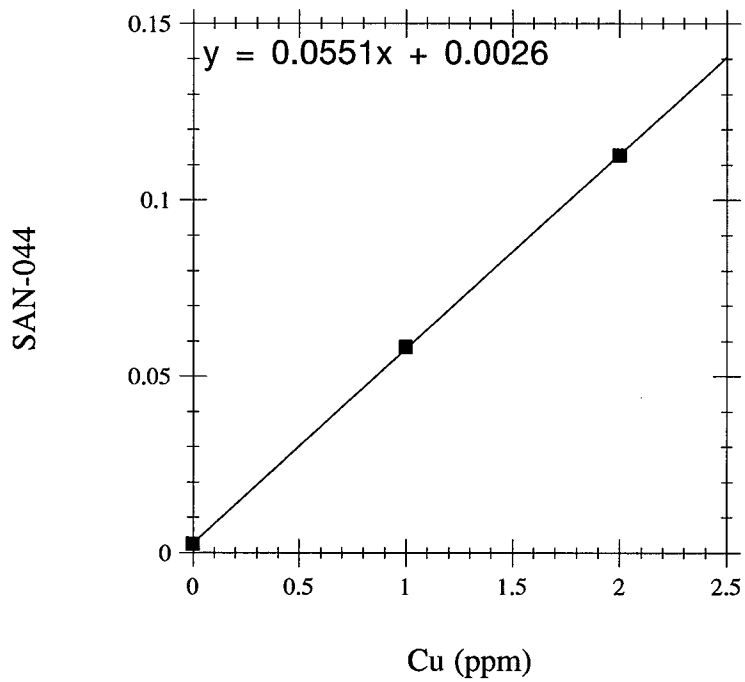
$.0882 \times 2 = .1764 \times \frac{8}{1.012} = 1.394$ ppm

SAN-043 MgCl2



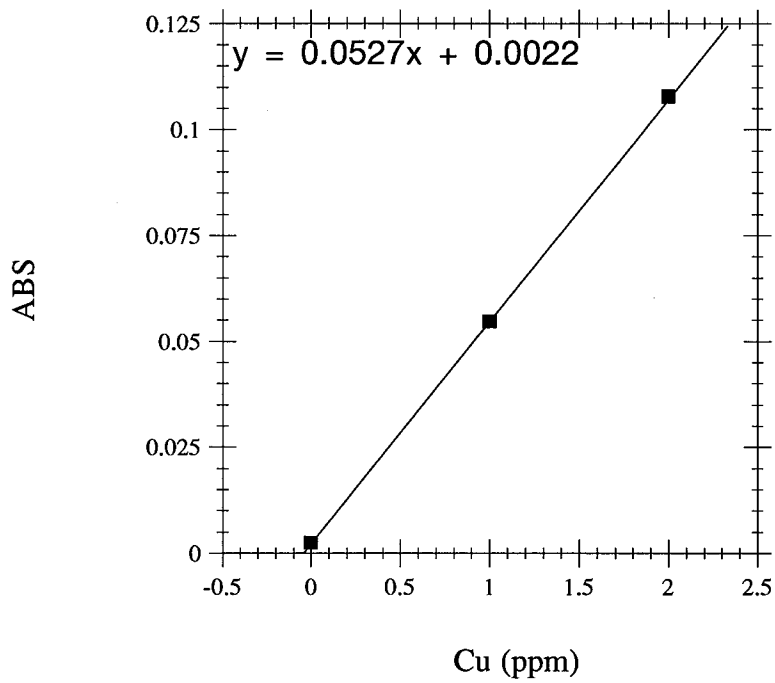
$.0963 \times 2 = .1926 \times \frac{8}{1.022} = 1.5098$ ppm

SAN-044 MgCl2



$.0472 \times 2 = .0944 \times \frac{8}{1.014} = .745\ ppm$

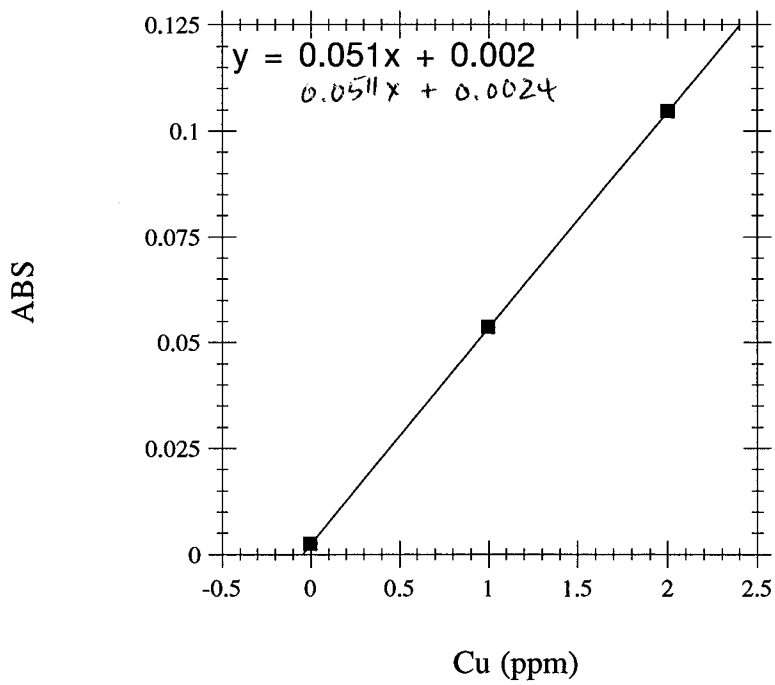
SAN-045 MgCl2



.0417 x 2 = .0834

$\frac{.0834 \times 8}{1.0168} = .656$ ppm

SAN-046 MgCl2

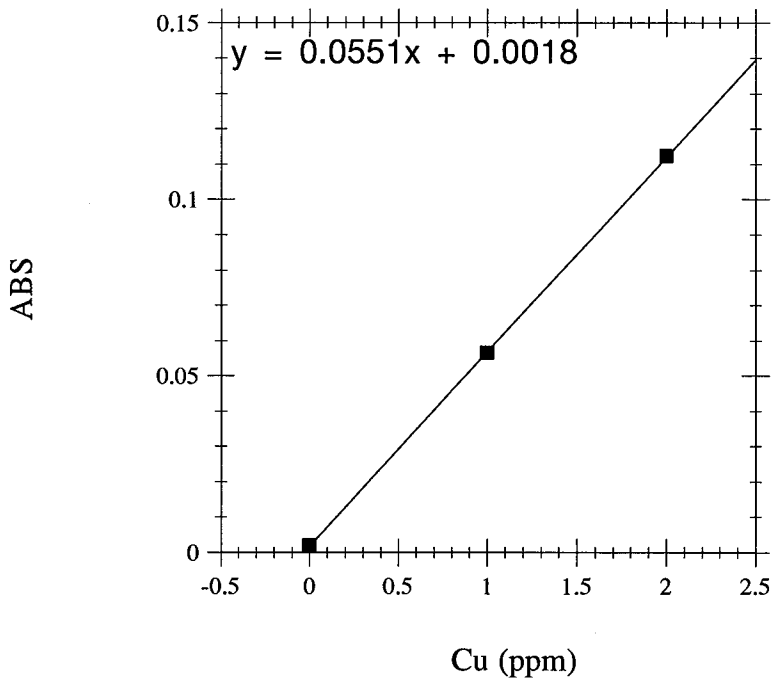


.0469

x 2 = .0938

$.0938 \times \frac{8}{1.022} = .734$ ppm

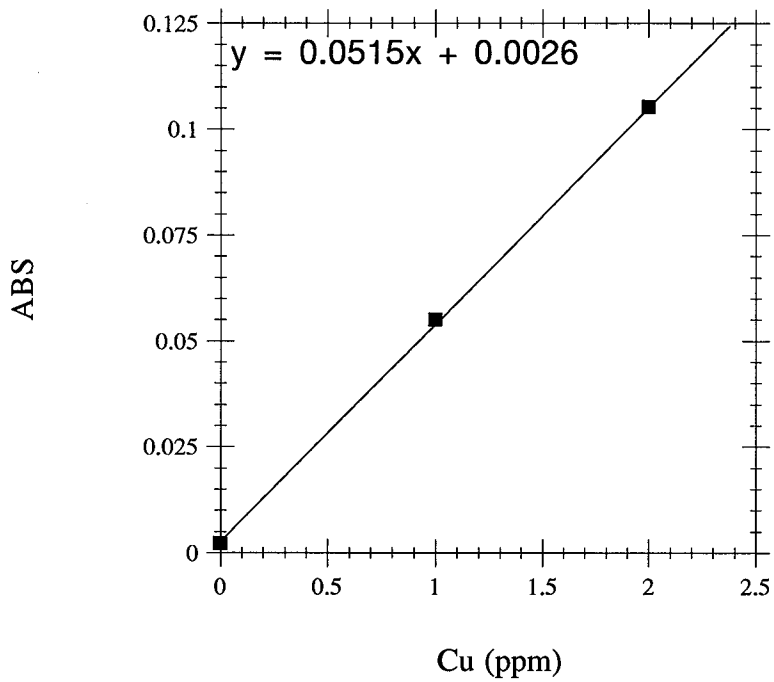
SAN-047



.0327 x 2 = .0654

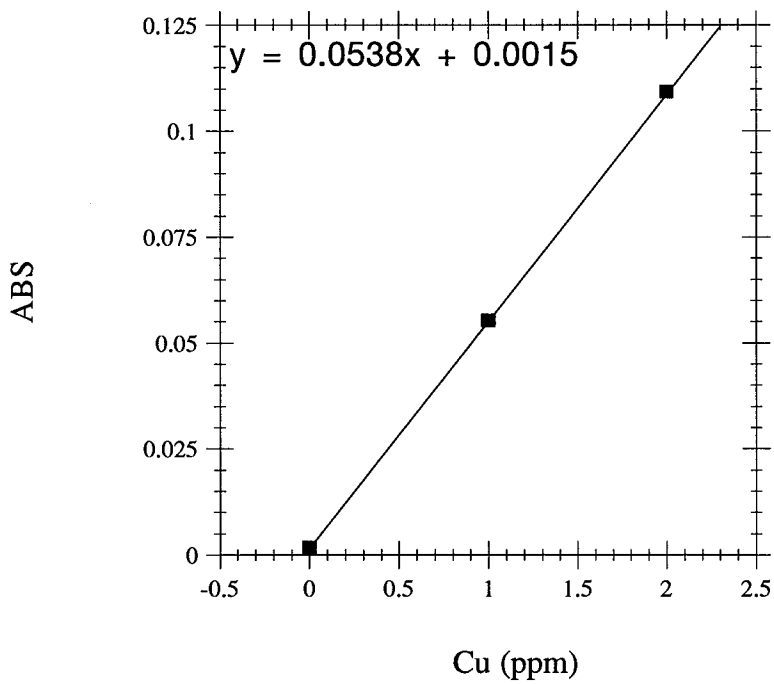
$\frac{.0654 \times 8}{1.0227}$ = .512 ppm

SAN-048 MgCl2



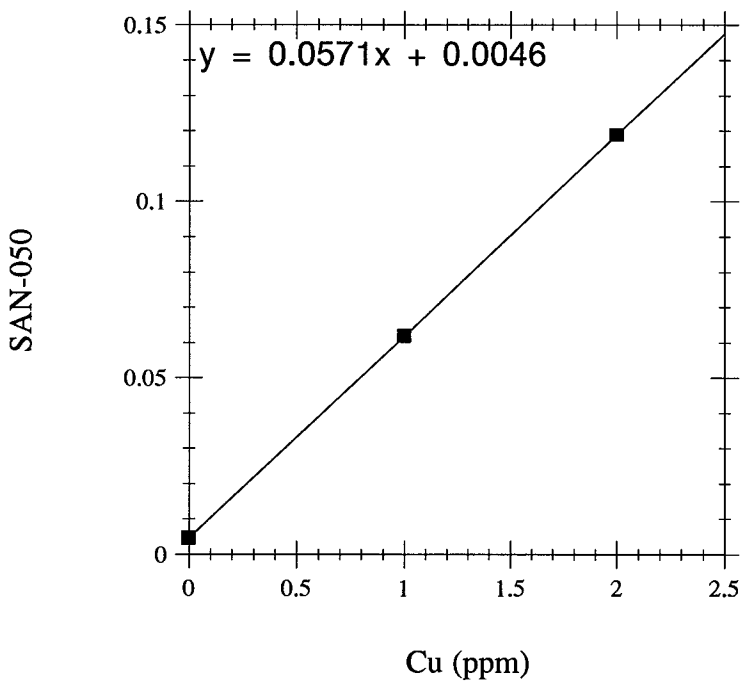
.0505 x 2 = .1010 x 8 / 1.022 = .791 ppm

SAN-049 MgCl2



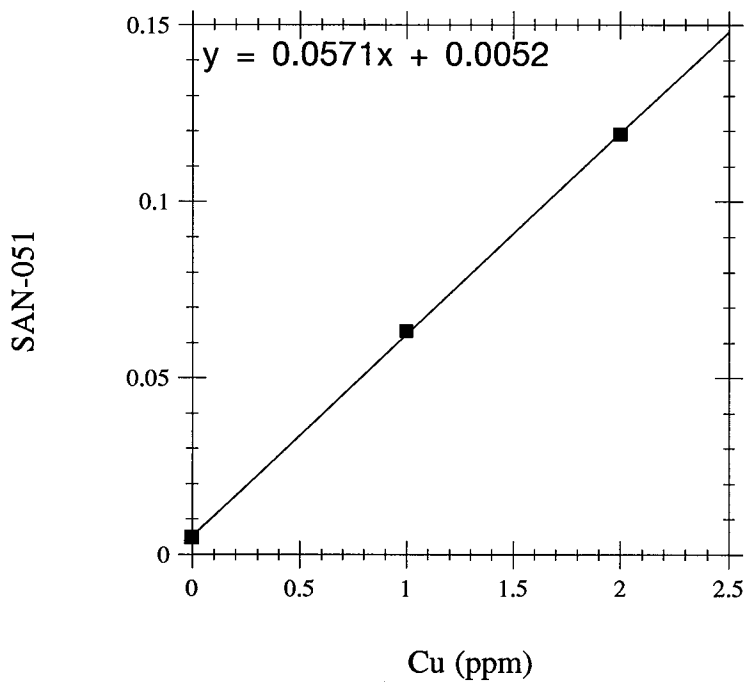
$.0279 \times 2 = .0558 \times \frac{8}{1.017} = .439$ ppm

SAN-050 MgCl2



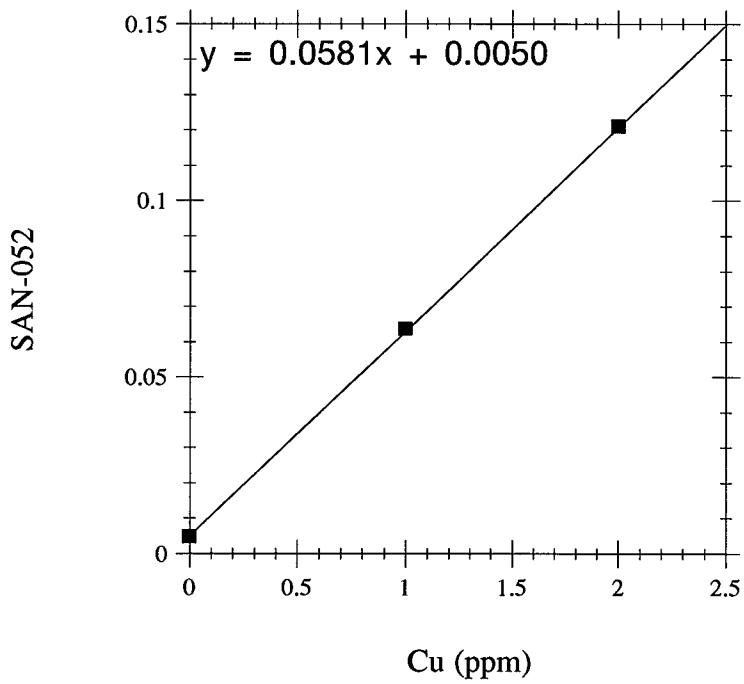
$.0806 \times 2 = .1612 \times \frac{8}{1.016} = 1.269\,ppm$

SAN-051 MgCl2



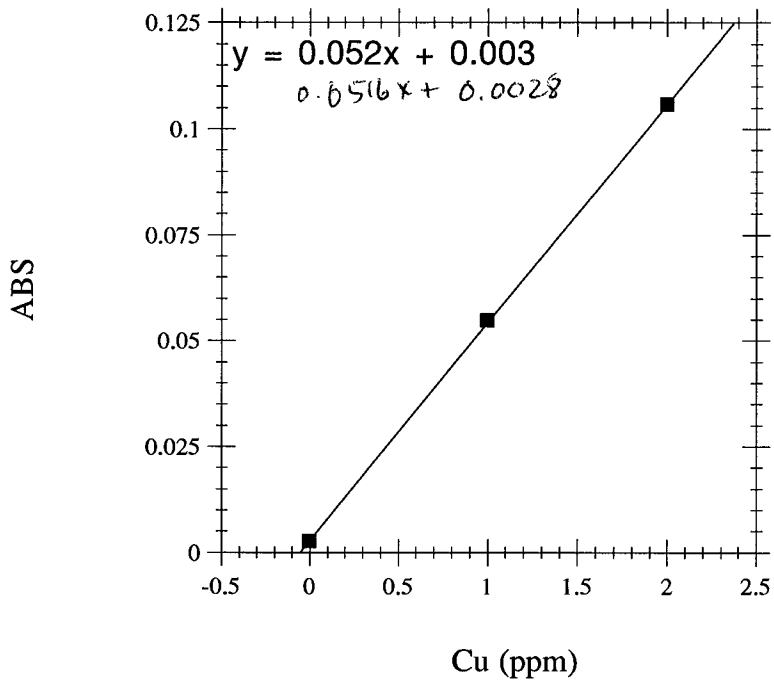
.0910 ÷ 2 = .182 × 8 / 1.017 = 1.432 ppm

SAN-052 MgCl2



$.0861 \times 2 = .1722 \times \frac{8}{1.02} = 1.351 ppm$

SAN-053 MgCl2

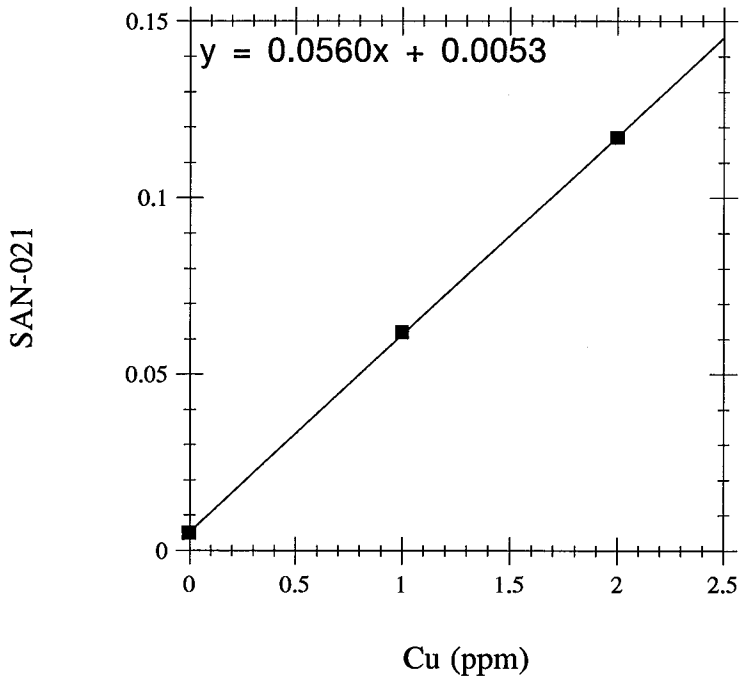


.0543

x2 = .1084

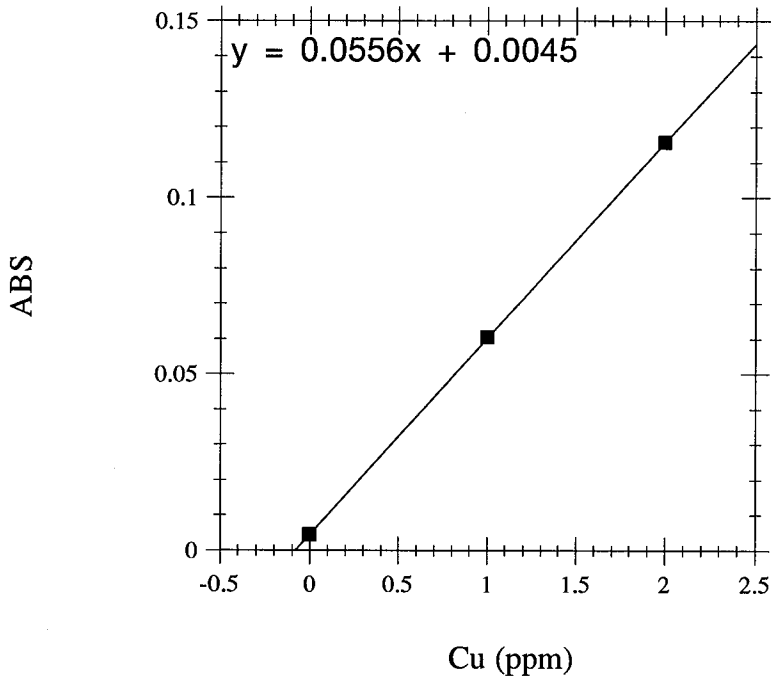
$.1086 \times \frac{8}{1.008} = .862$ ppm

SAN-021 NaOAc



$.0946 \times 2 = .1892 \times \frac{8}{1.016} = 1.489$ ppm

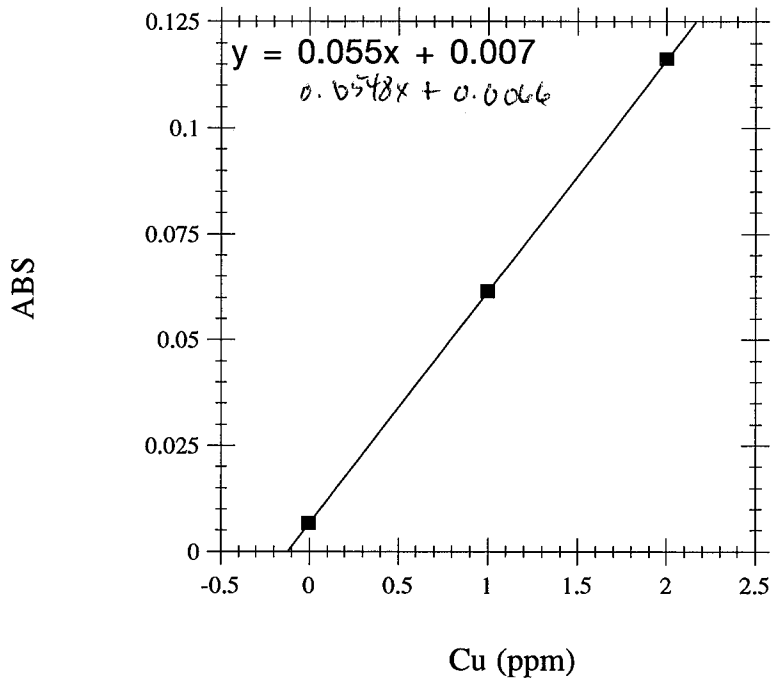
SAN-022 NaOAc



.0809 x2 = .1618

.1618 x 8/1.022 = 1.2266 ppm

SAN-023 NaOAc

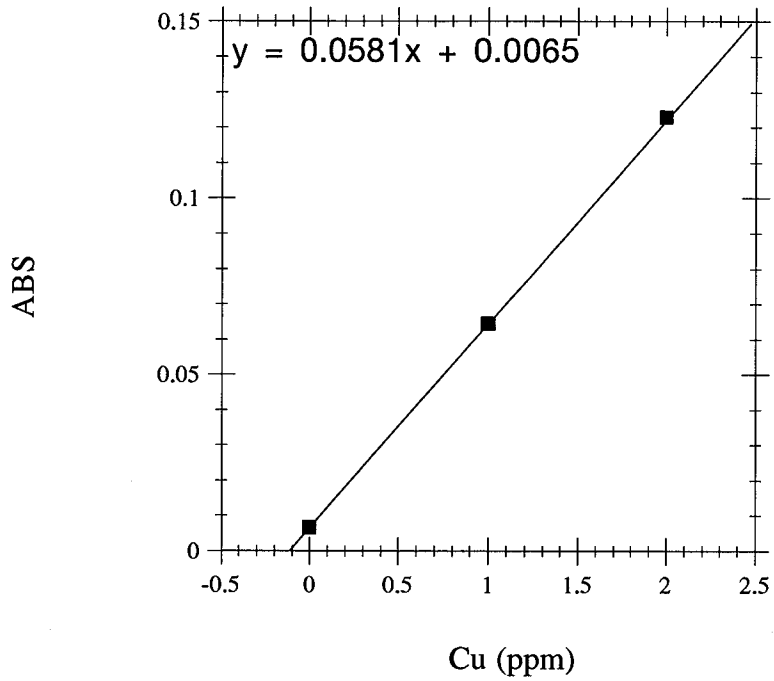


.1204

x2 = .2408

$.2408 \times \frac{8}{1.022} = 1.885$ ppm

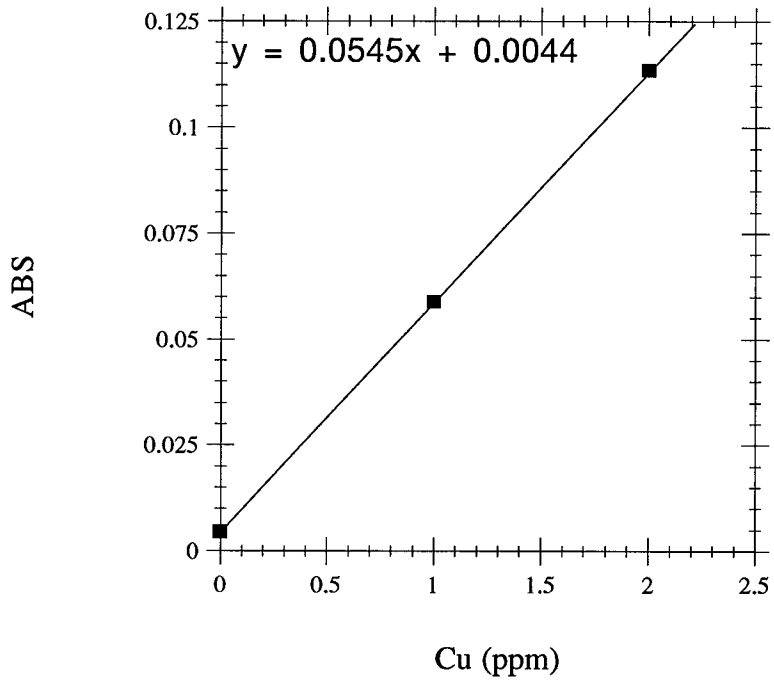
SAN-024 NaOAc



.11188 x 2 = .2238

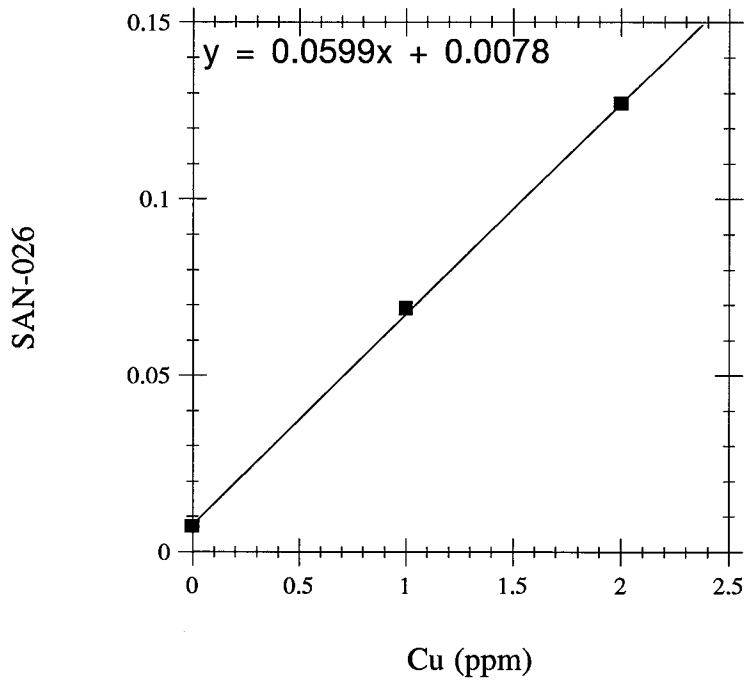
.2238 x 8/1.0183 = 1.759 ppm

SAN-025 NaOAc



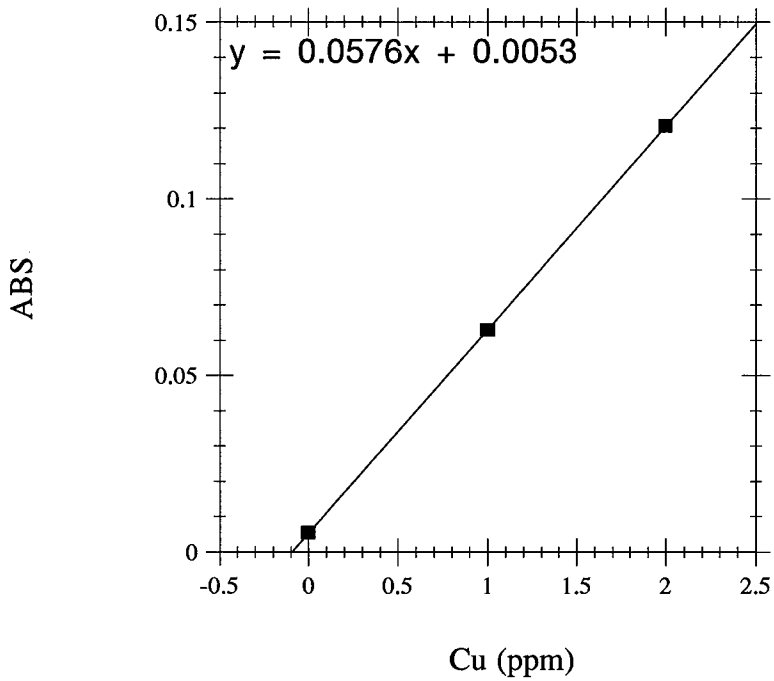
$.0807 \times 2 = .1614 \times \frac{8}{1.025} = \underline{1.26 ppm}$

SAN-026 NaOAc



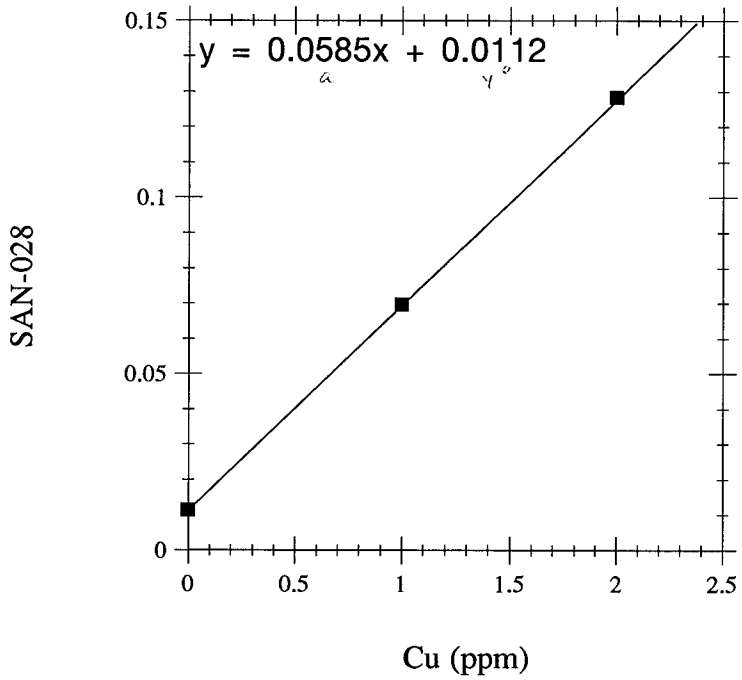
.1302 x 2 = .2604 x 8/1.021 = 2.04 ppm

SAN-027 NaOAc



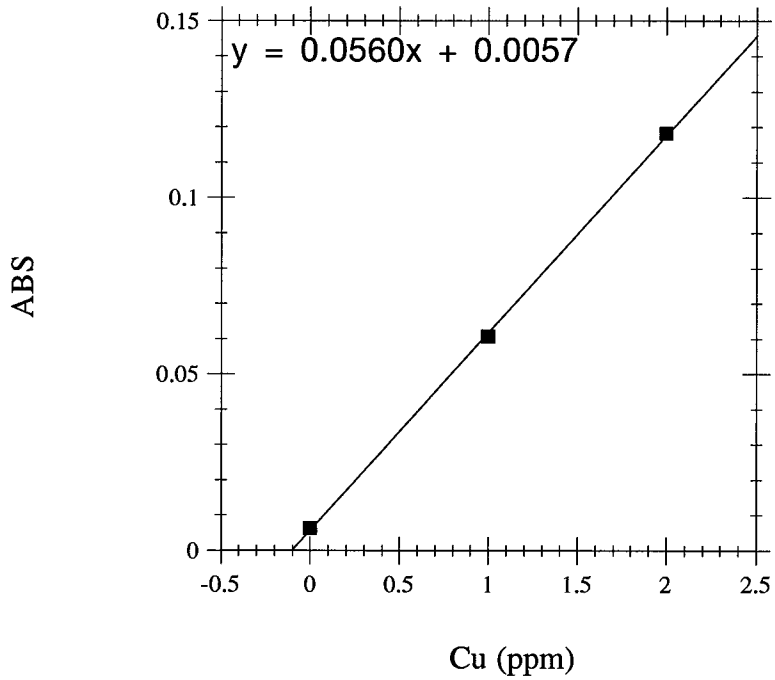
$.092 \times 2 = .184 \times \frac{8}{1.013} = \underline{1.453 \text{ ppm}}$

SAN-028 NaOAc



$.1914 \times 2 = .3828 \times \frac{8}{1.023} = 2.993\,ppm$

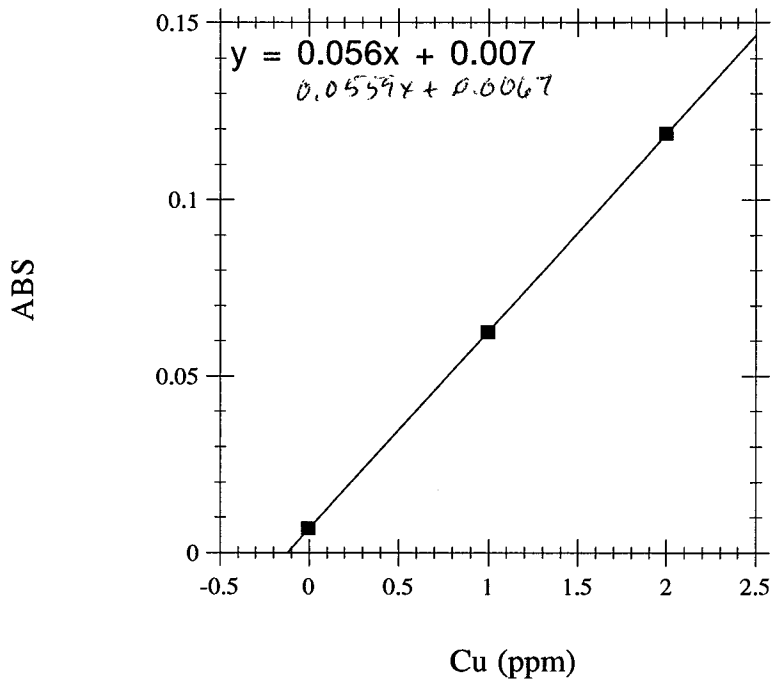
SAN-029 NaOAc



.1018 x 2 = .2036

.2036 x 8/1.020 = 1.597 ppm

SAN-030 NaOAc

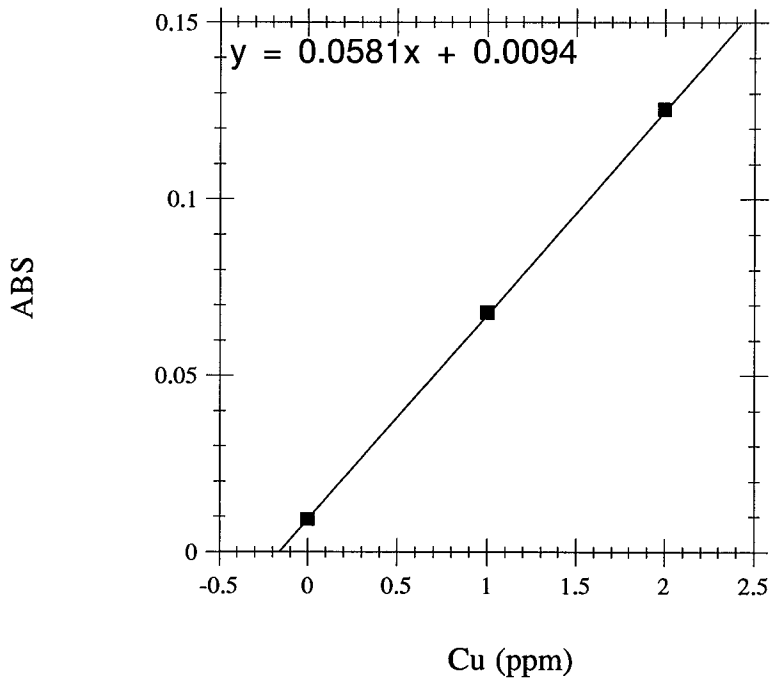


.1198

x2 = .2396

$.2396 \times \frac{8}{1.022} = 1.875$ ppm

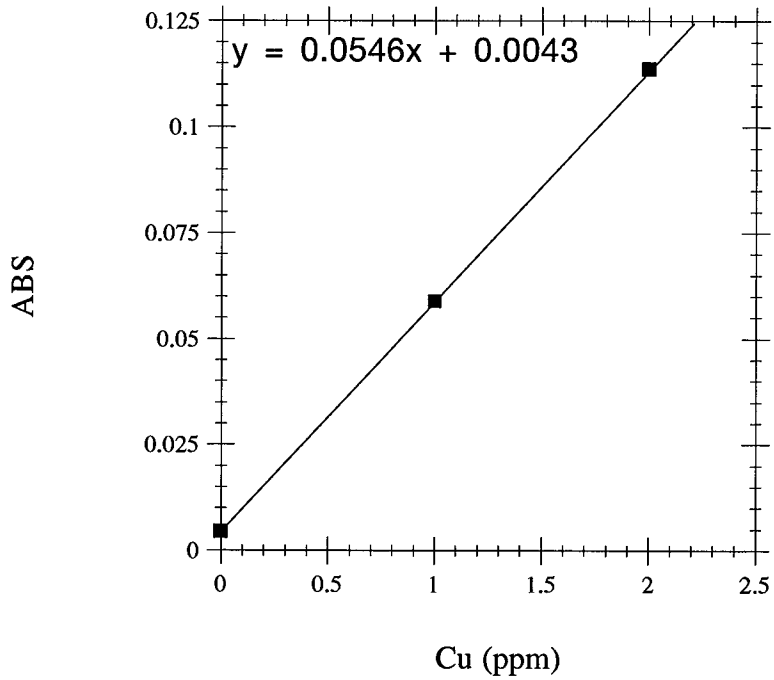
SAN-031 NaOAc



.1618 x 2 = .3236

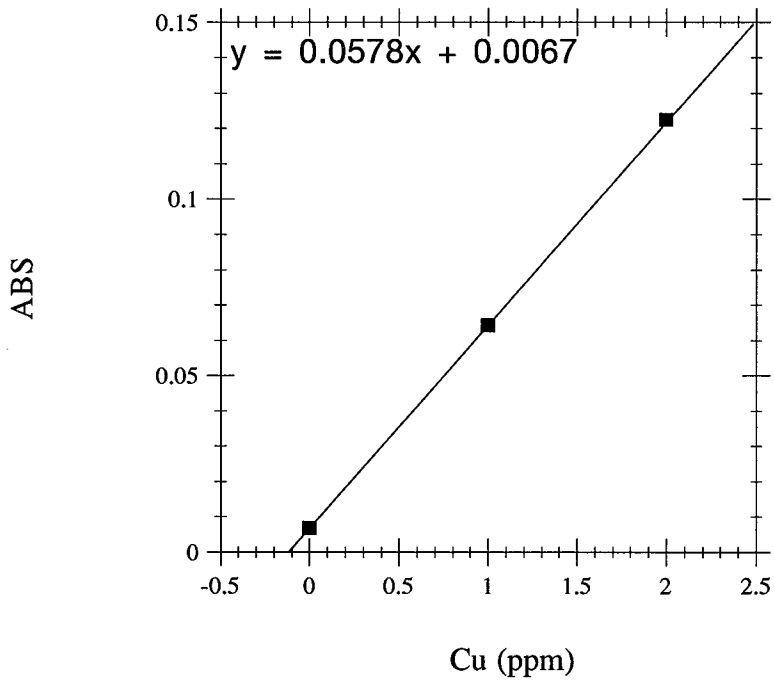
$.3236 + \frac{8}{1.0258} = 2.524$ ppm

SAN-032 NaOAc



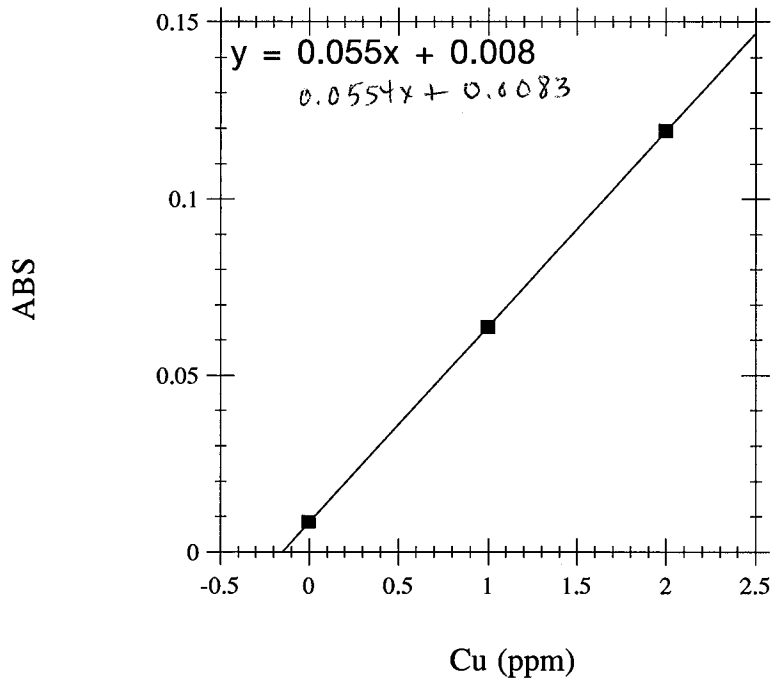
$.0787 \times 2 = .1574 \times \frac{8}{1.017} = 1.238$ ppm

SAN-033 NaOAc



.1159 x 2 = .2318 x 8/1.012 = 1.832 ppm

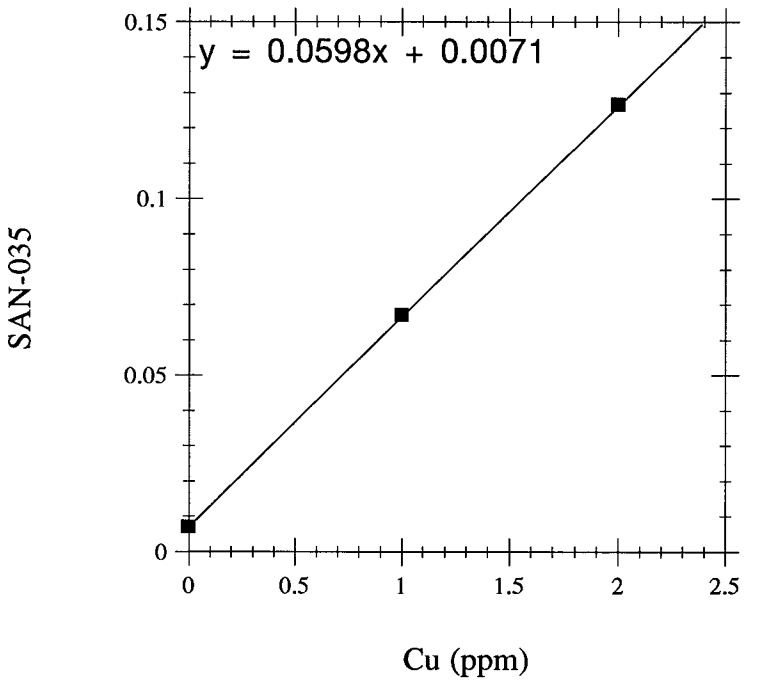
SAN-034 NaOAc



.1498
x2 = .2996

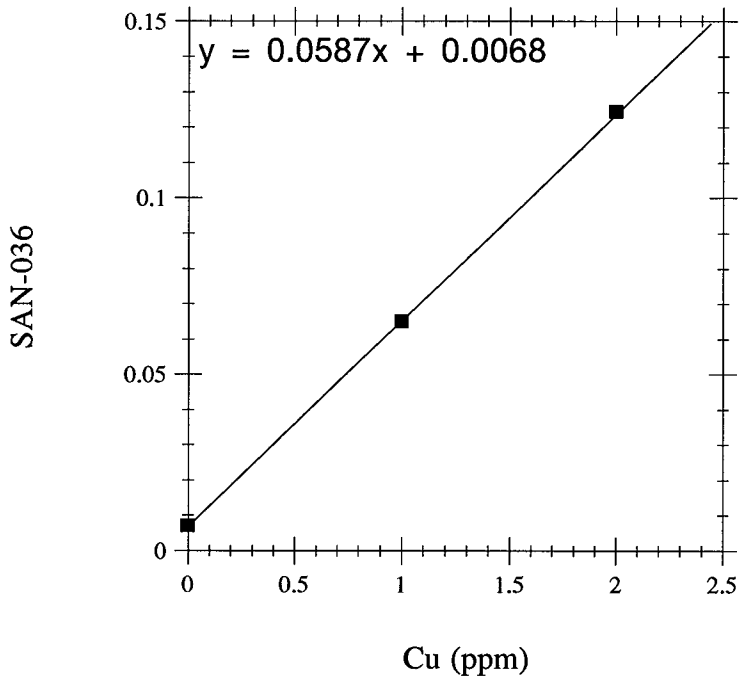
$.2996 \times \frac{8}{1.009} = 2.375$ ppm

SAN-035 NaOAc



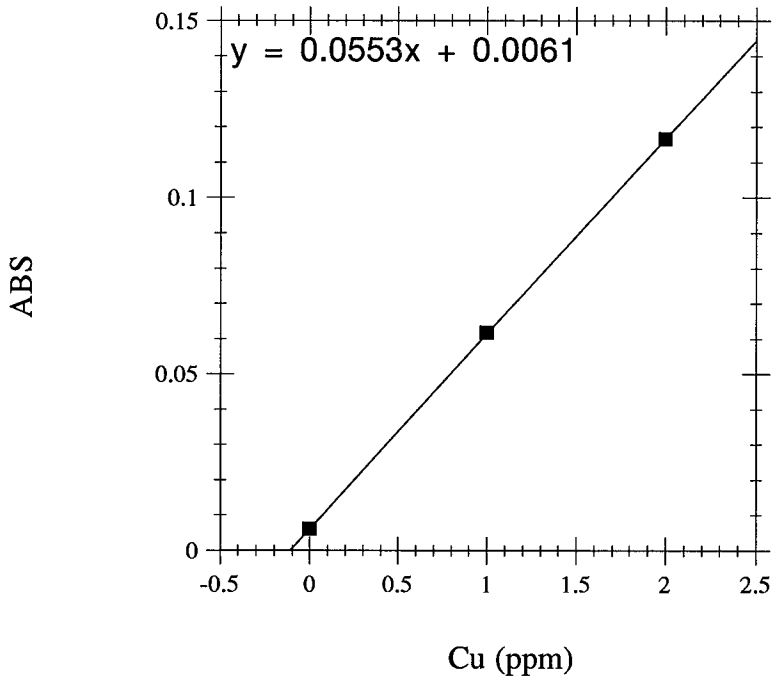
$.1187 \times 2 = .2374 \times \frac{8}{1.02} = 1.862$ ppm

SAN-036 NaOAc



$.1158 \times 2 = .2316 \times \frac{8}{1.014} = 1.827$ ppm

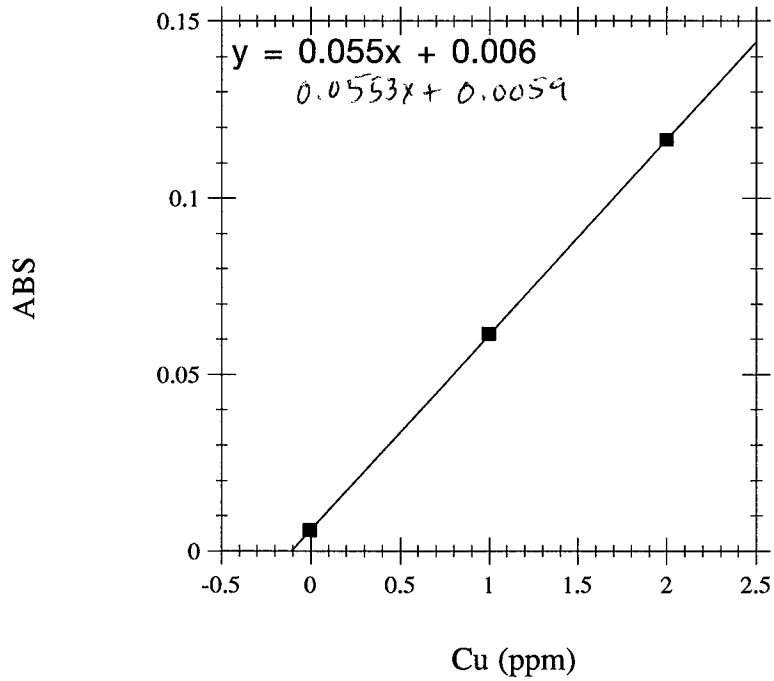
SAN-037 NaOAc



.1103 x 2 = .2206

$.2206 \times \frac{8}{1.021} = 1.728$ ppm

SAN-038 NaOAc

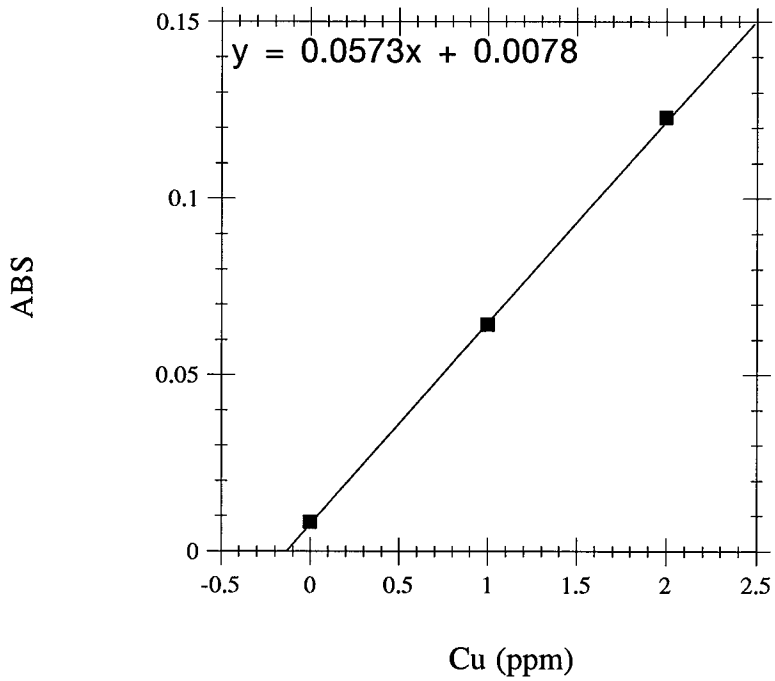


.1067

x2 = .2134

$.2134 \times \frac{8}{1.024} = 1.667$ ppm

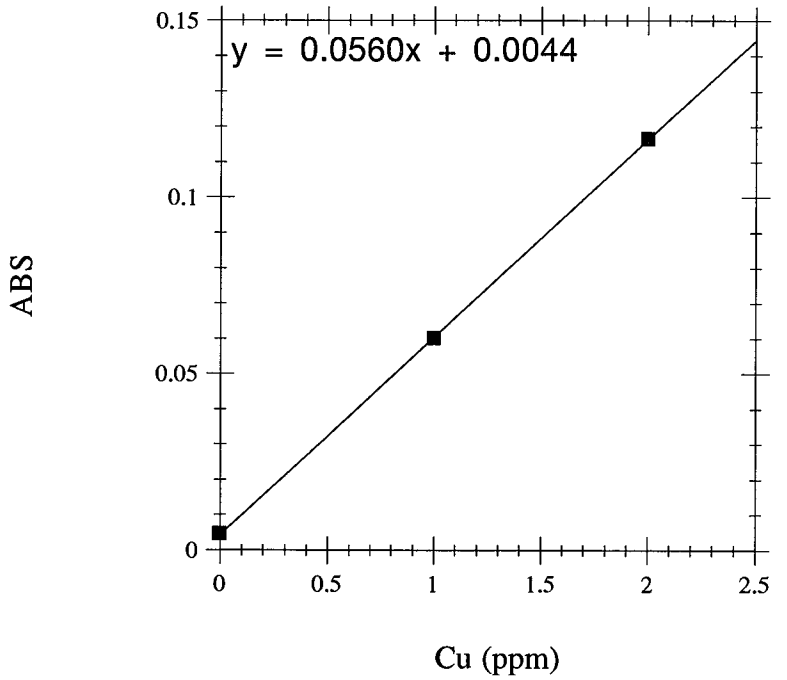
SAN-039 NaOAc



.1361 x 2 = .2722

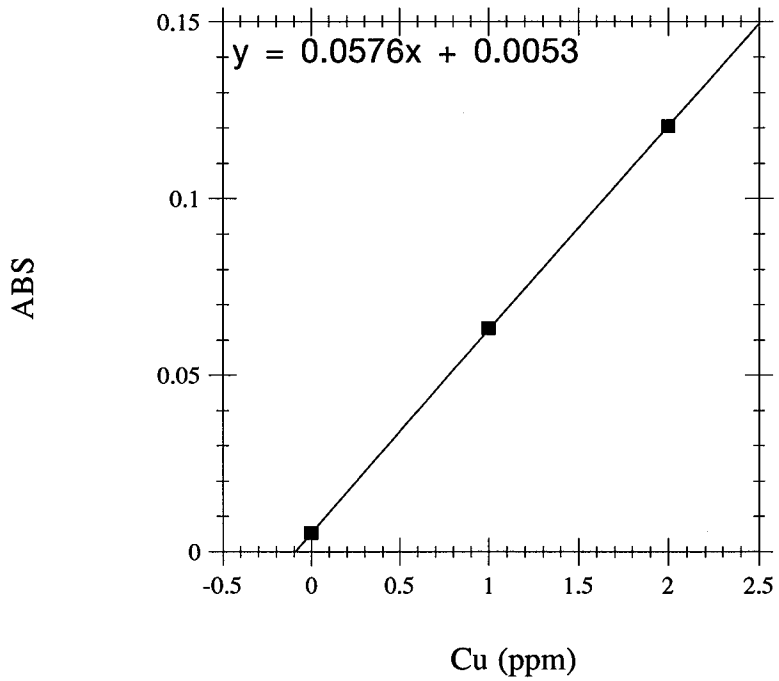
$.2722 \times \frac{8}{1.018} = 2.139$ ppm

SAN-040 NaOAc



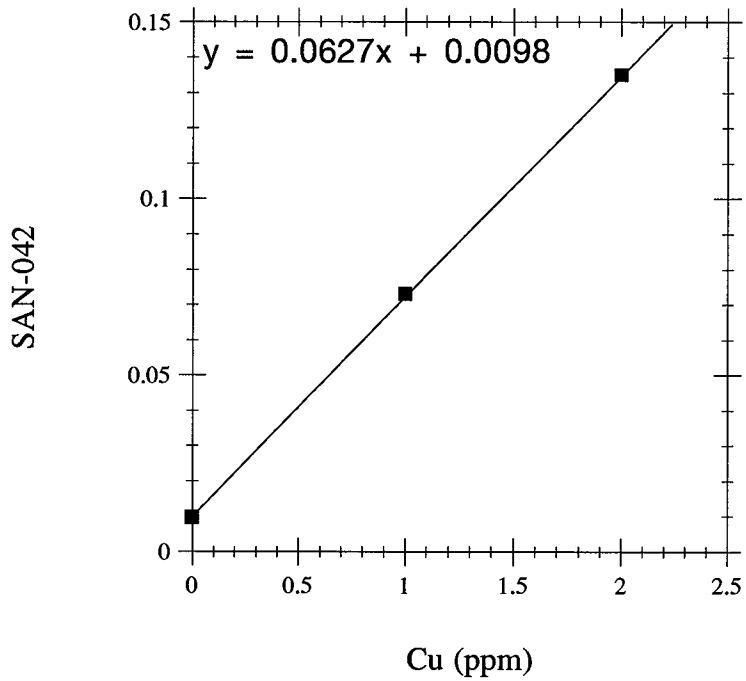
$.0786 \times 2 = .1572 \times \frac{8}{1.017} = 1.236$ ppm

SAN-041 NaOAc



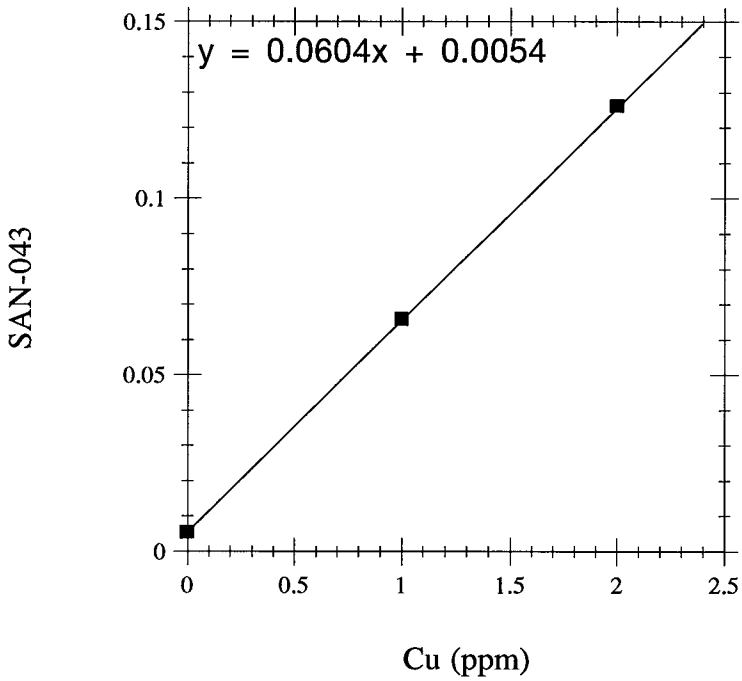
$.092 \times 2 = .184 \times \frac{8}{1.015} = \underline{1.45 \text{ ppm}}$

SAN-042 NaOAc



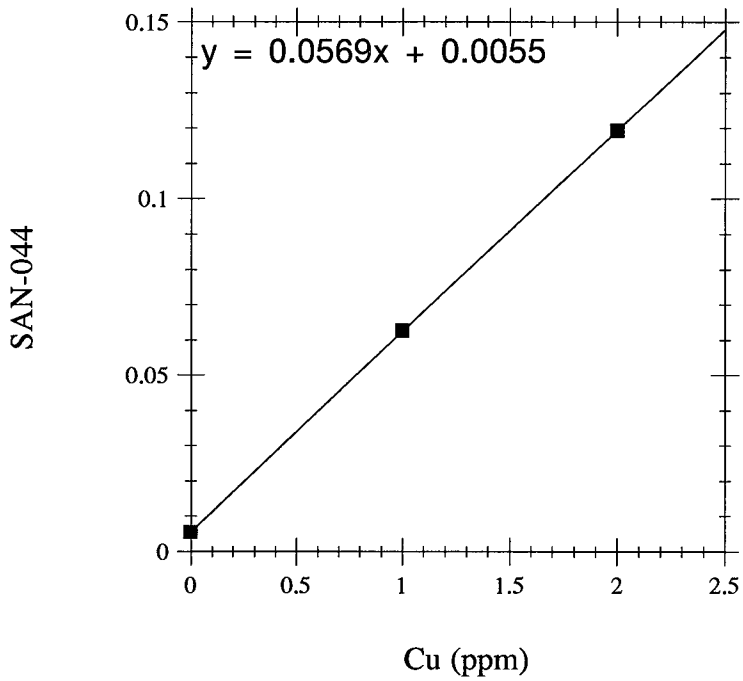
.1563 x 2 = .3126 x 8/1.012 = 2.471 ppm

SAN-043 NaOAc



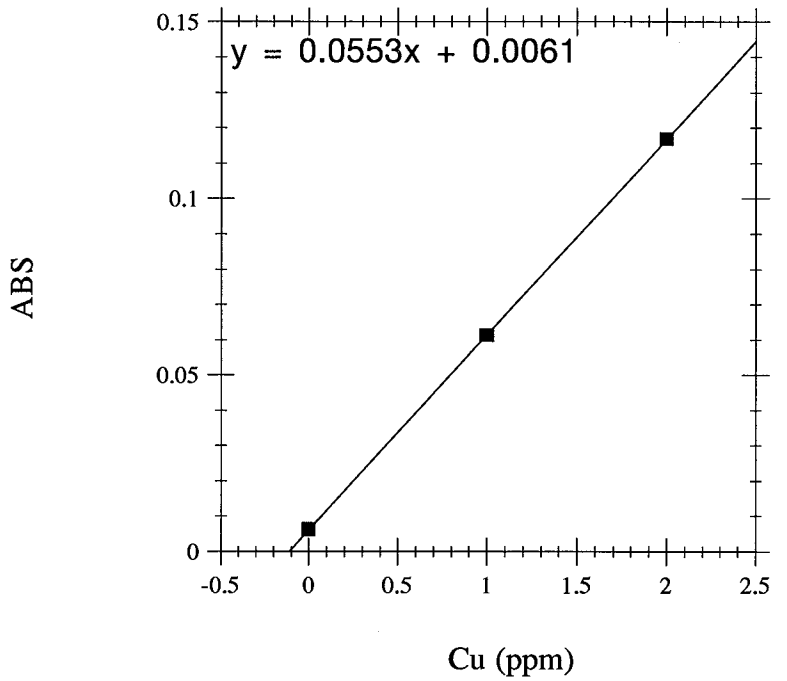
$.0894 \times 2 = .1788 \times \frac{8}{1.022} = 1.3996 \text{ ppm}$

SAN-044 NaOAc



$.0967 \times 2 = .1934 \times \frac{8}{1.014} = 1.526$ ppm

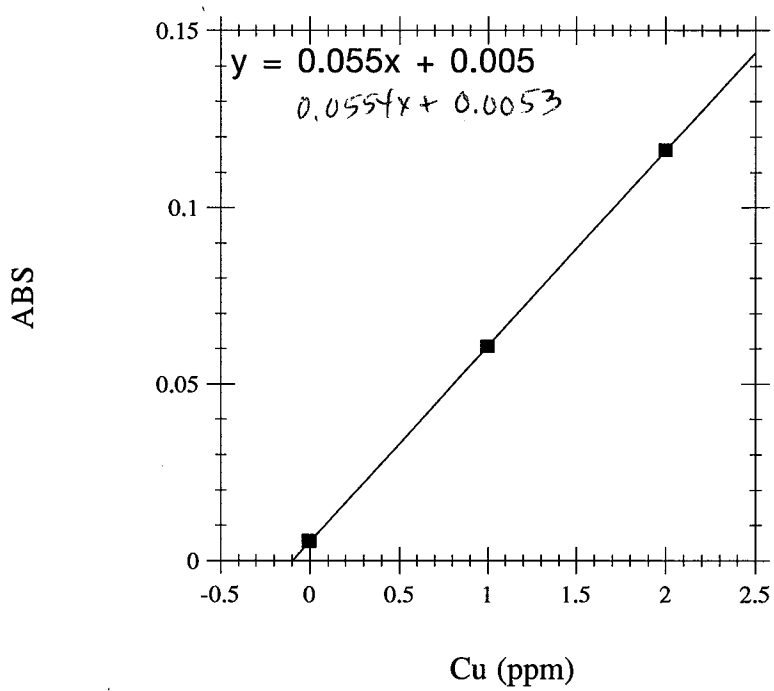
SAN-045 NaOAc



.1103 x 2 = .2206

.2206 x 8/1.021 = 1.728 ppm

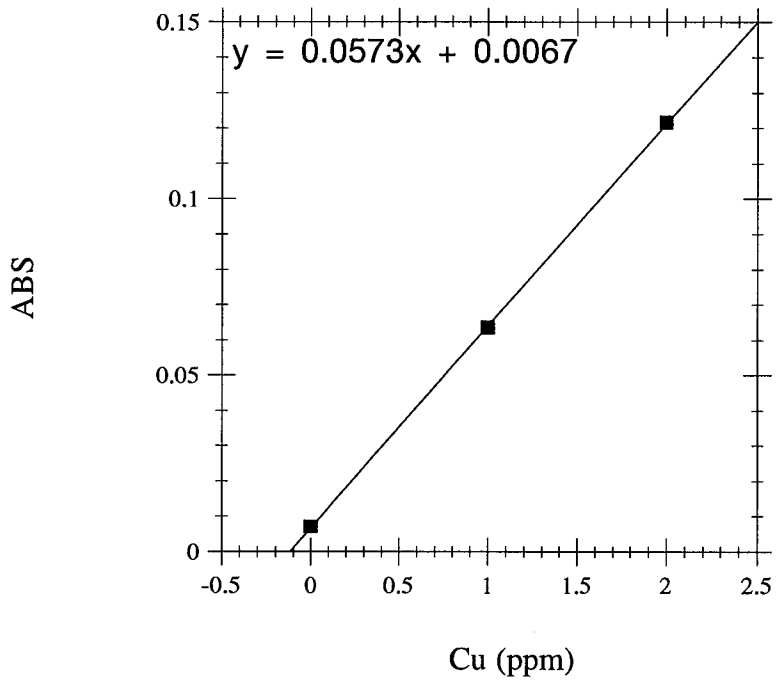
SAN-046 NaOAc



.0957
x2 = .1914

$.1914 \times \frac{8}{1.022} = 1.498$ ppm

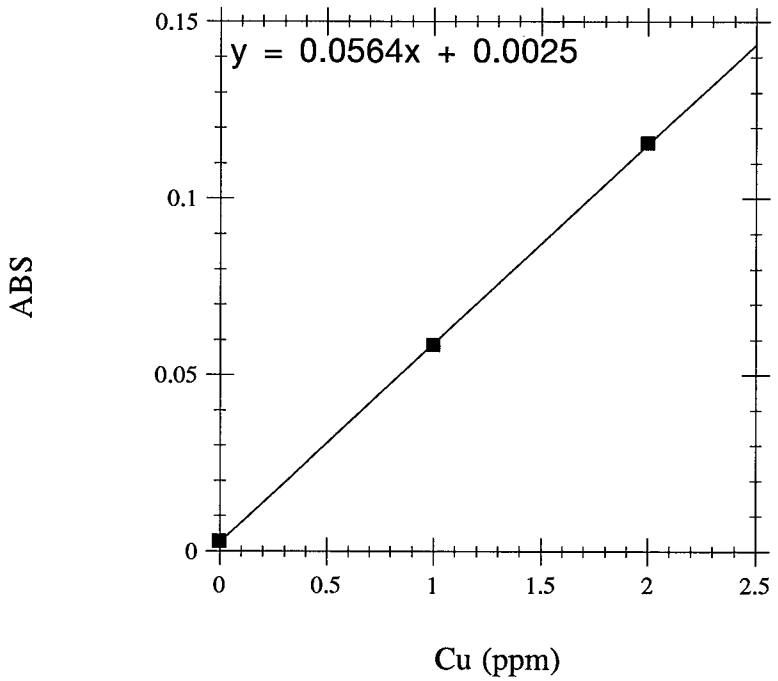
SAN-047 NaOAc



.1169 x 2 = .2338

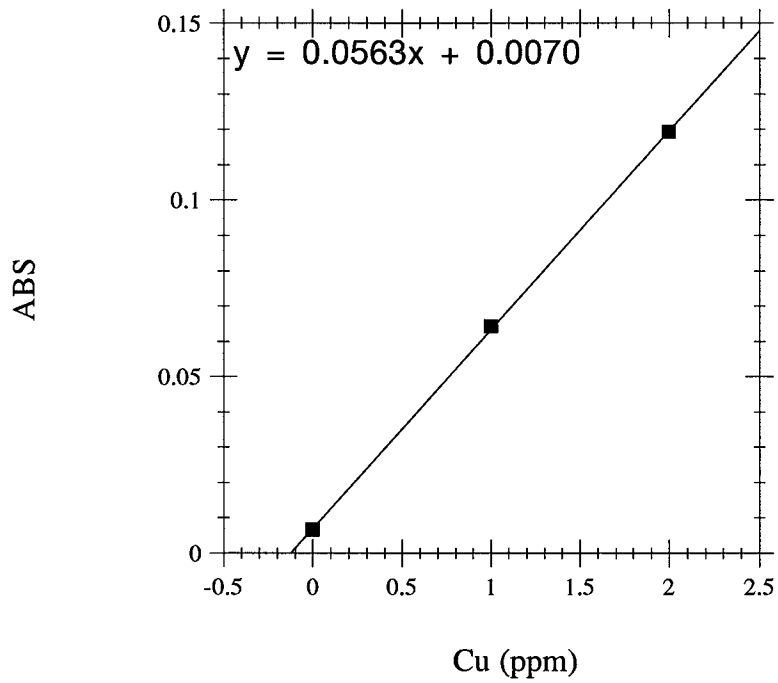
.2338 x 8/1.023 = 1.828 ppm

SAN-048 NaOAc



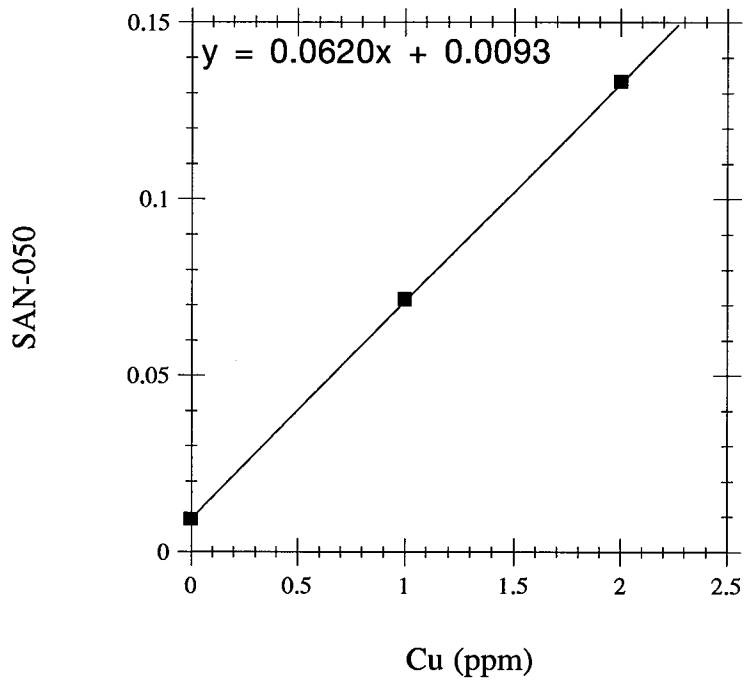
$.6443 \times 2 = .0886 \times \frac{8}{1.022} = .693$ ppm

SAN-049 NaOAc



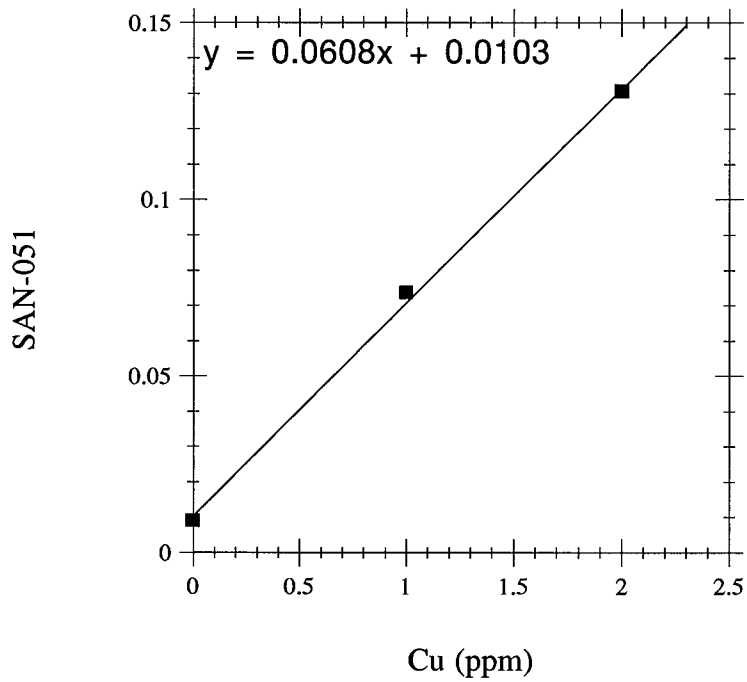
$.1243 \times 2 = .2486 \times \frac{8}{1.017} = 1.955 ppm$

SAN-050 NaOAc



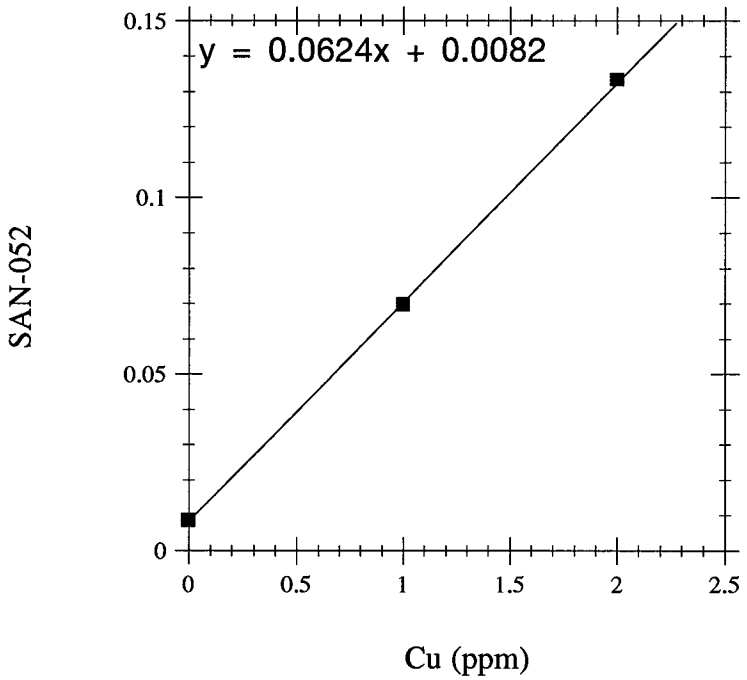
$.15 \times 2 = .3 \times \frac{8}{1.016} = 2.362$ ppm

SAN-051 NaOAc



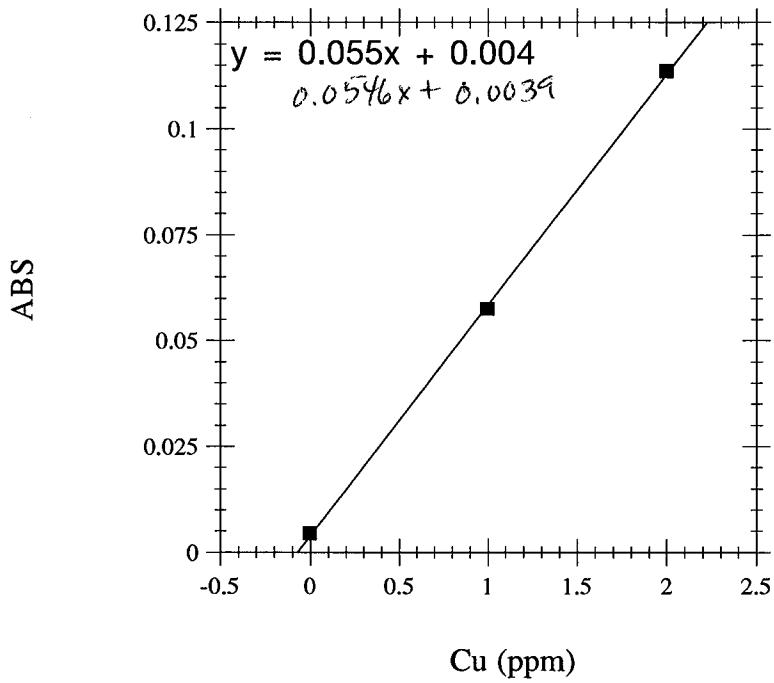
$.1694 \times 2 = .3388 \times \frac{.8}{1.017} = 2.665$ ppm

SAN-052 NaOAc



$.1314 \times 2 = .2628 \times \frac{8}{1.02} = 2.061$ ppm

SAN-053 NaOAc

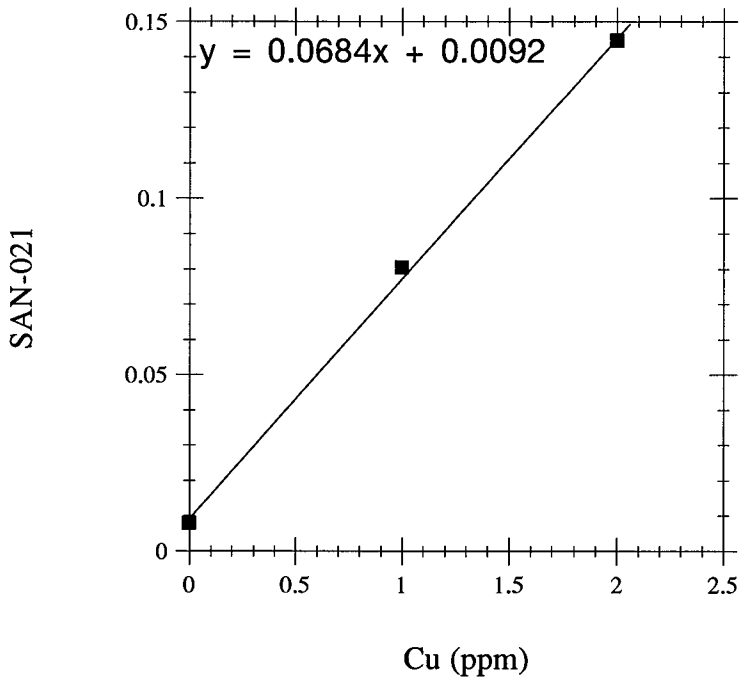


.0714

x2 = .1428

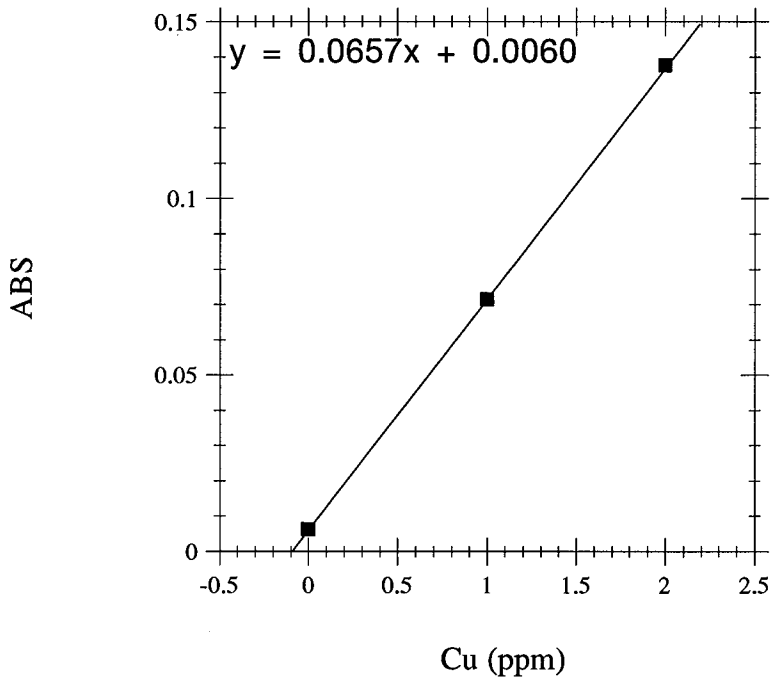
$.1428 \times \frac{8}{1.008} = 1.133$ ppm

SAN-021 NH2OH



$.1345 \times 2 = .269 \times \frac{8}{1.016} = 2.118$ ppm

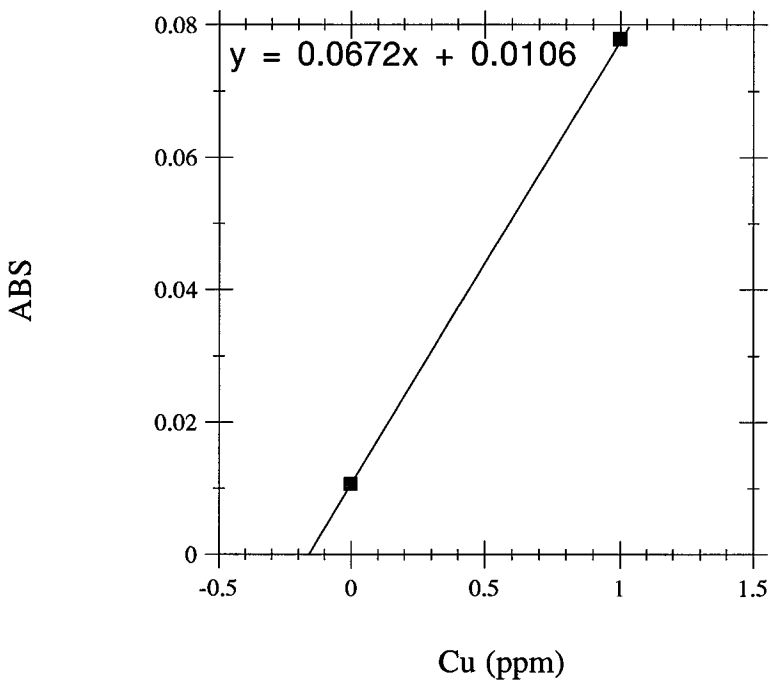
SAN-022 NH2OH



.0913 x 2 = .1826

.1826 x 8/1.022 = 1.429 ppm

SAN-023 NH2OH

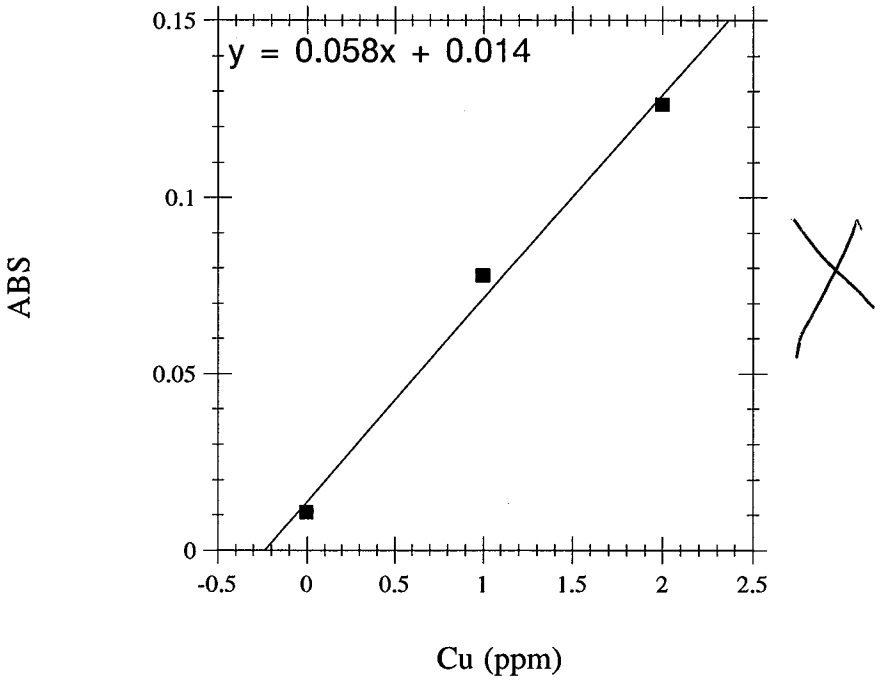


.1577

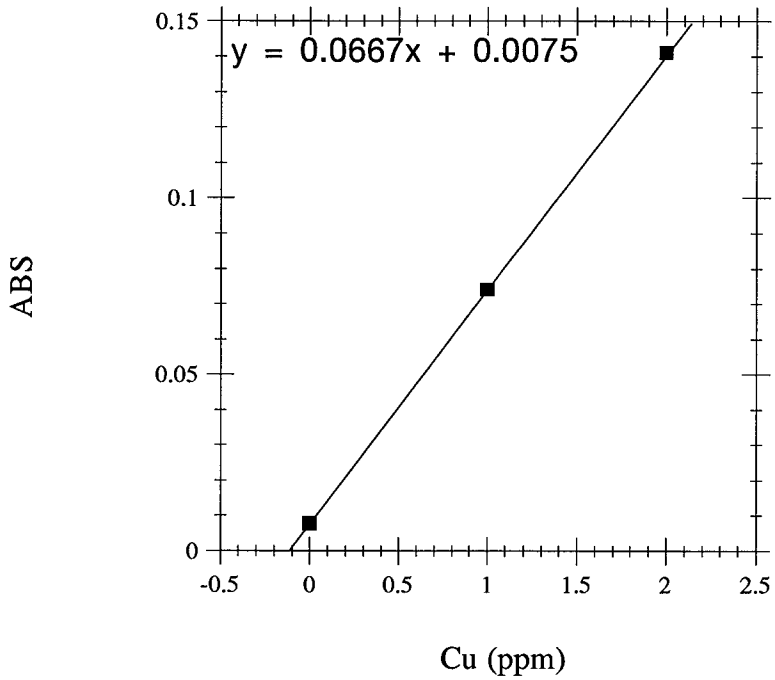
x2 = 0.3154

$.3154 \times \frac{8}{1.022} = 2.469$ ppm

SAN-023 NH2OH



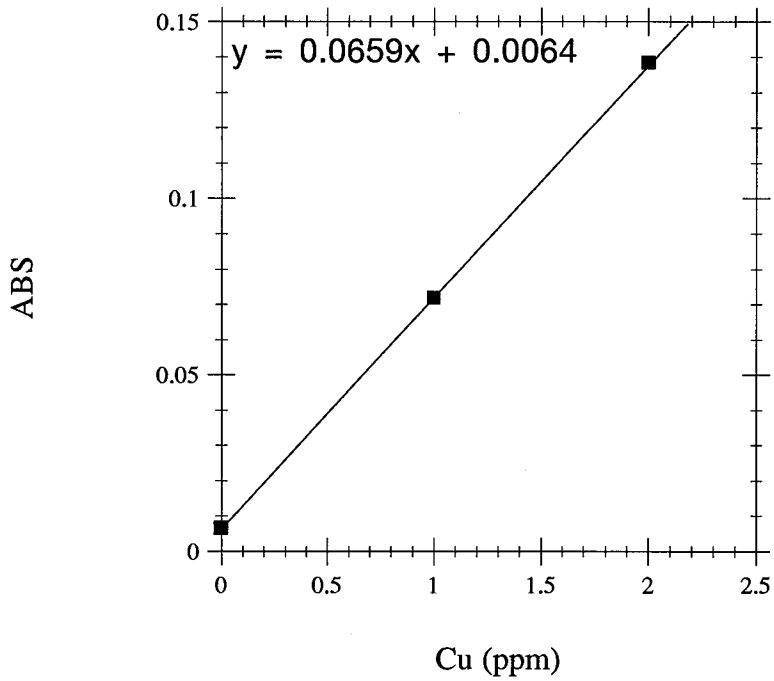
SAN-024 NH2OH



.1124 x 2 = .2248

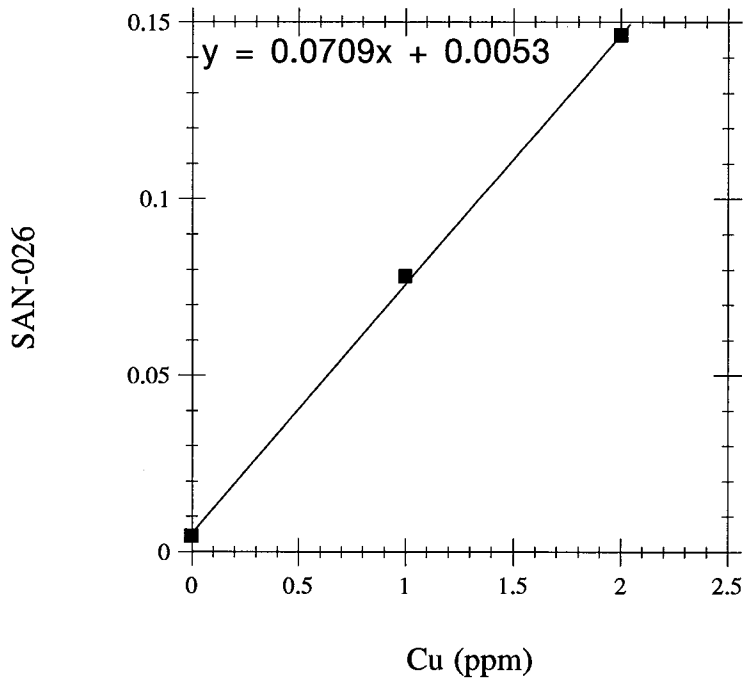
.2248 + 8/1.018 = 1.767 ppm

SAN-025 NH2OH



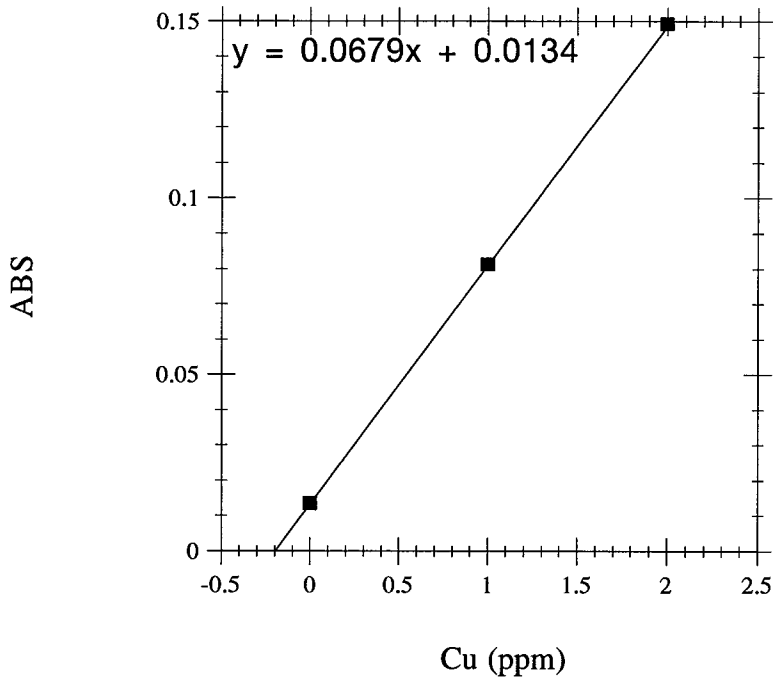
$.09710 \times 2 = .19424 \times \frac{8}{1.025} = \underline{1.516 \text{ ppm}}$

SAN-026 NH2OH



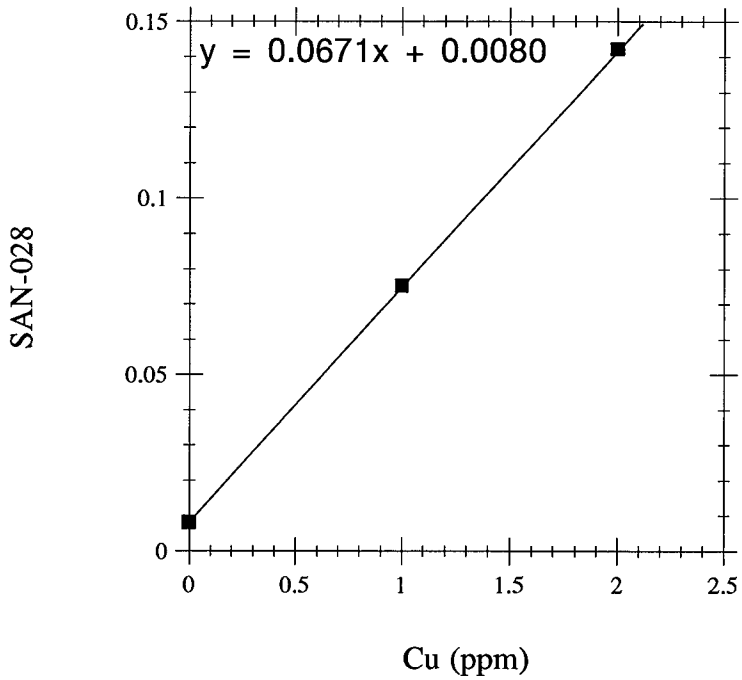
$.0747 \times 2 = .1494 \times \frac{8}{1.021} = 1.171$ ppm

SAN-027 NH2OH



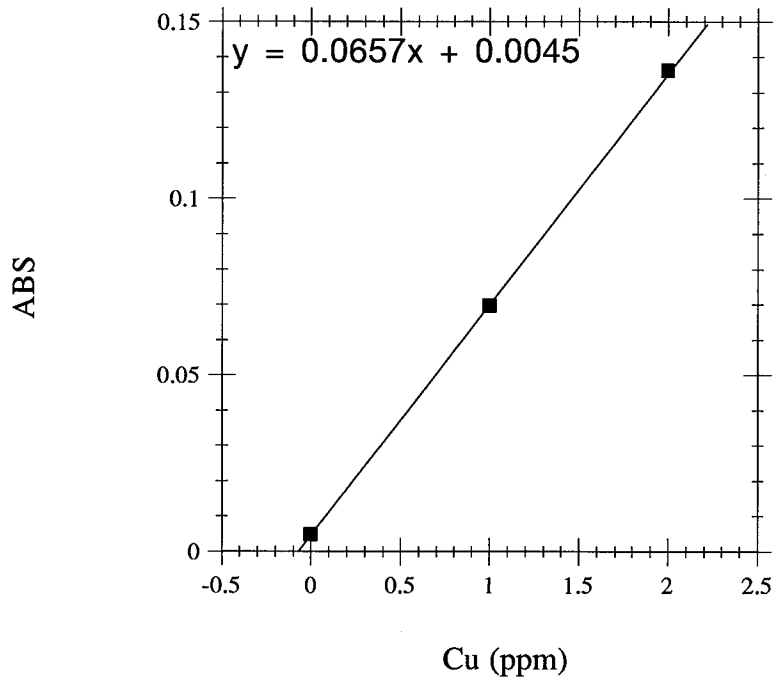
$.1973 \times 2 = .3946 \times \frac{8}{1.013} = \underline{3.116 \text{ ppm}}$

SAN-028 NH2OH



$.1192 \times 2 = .2384 \times 8 / 1.023 = 1.864$ ppm

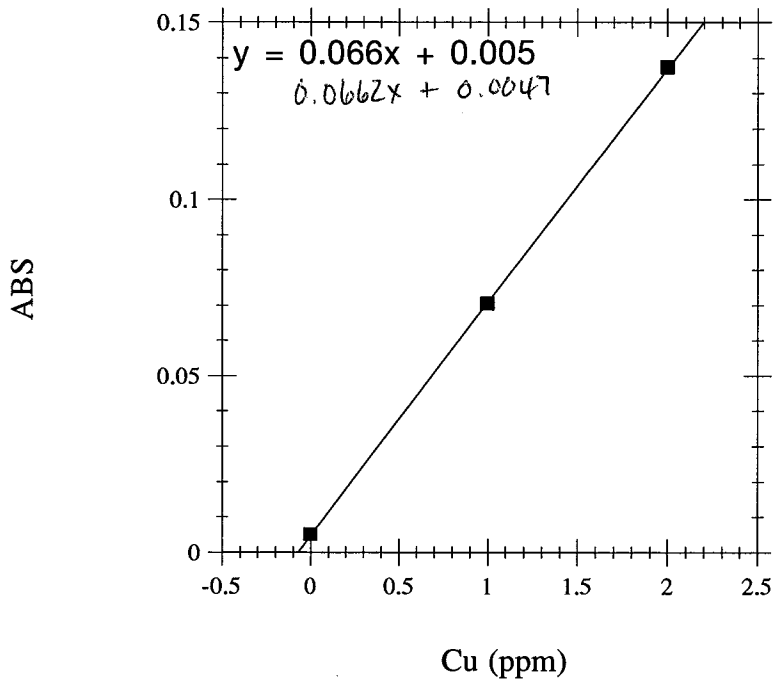
SAN-029 NH2OH



.0685 x 2 = .137

$.137 \times \frac{8}{1.020} = 1.074$ ppm

SAN-030 NH2OH

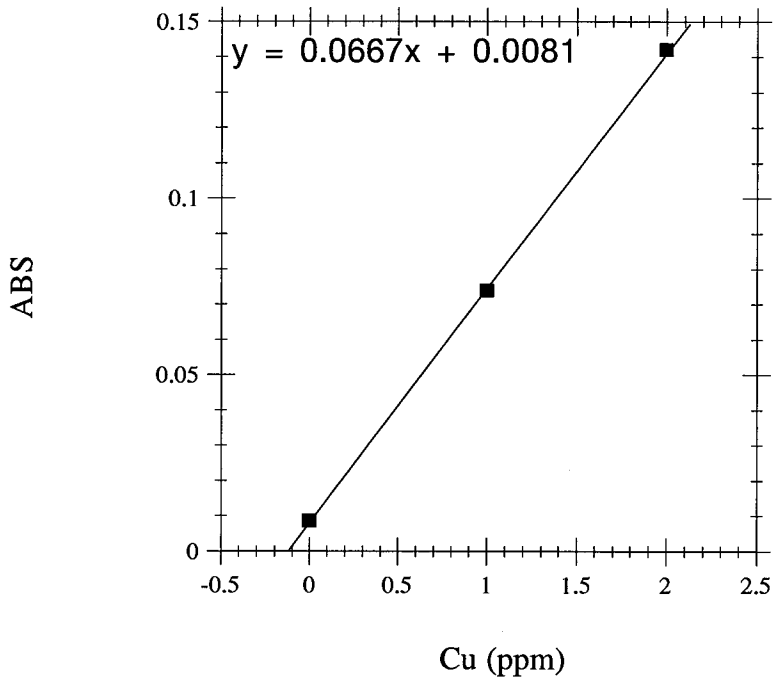


.071

x2 = .142

$.142 \times \frac{8}{1.022} = \underline{1.111 \text{ ppm}}$

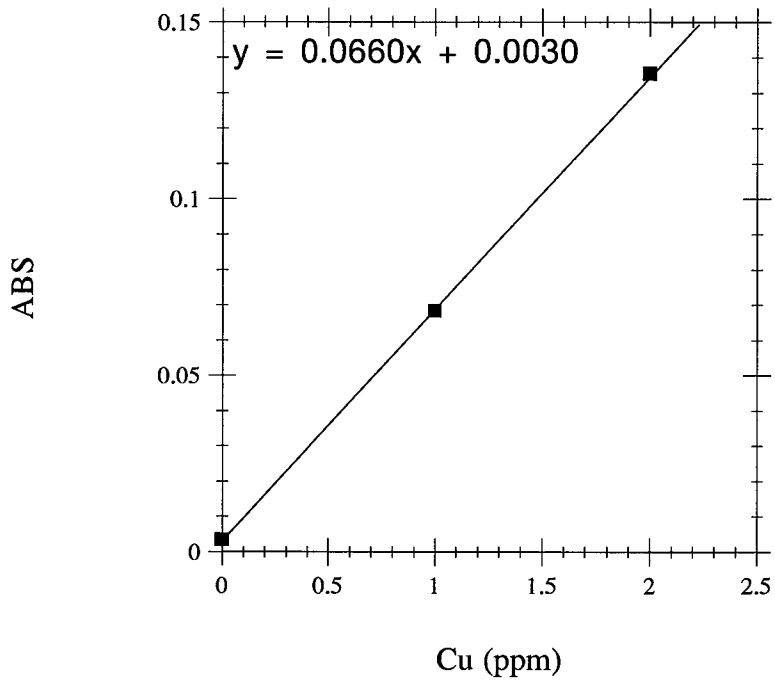
SAN-031 NH2OH



.1214 x 2 = .2428

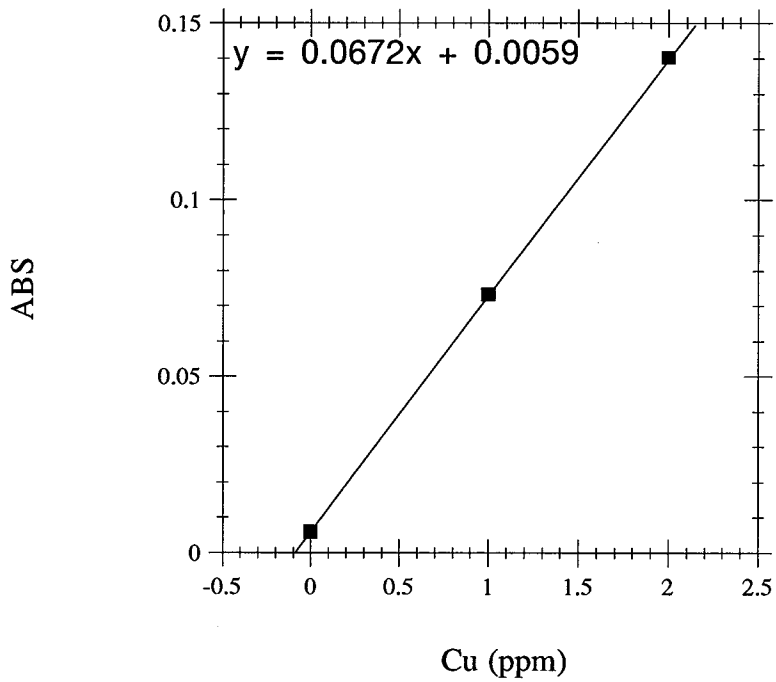
.2428 x 8/1.026 = 1.893 ppm

SAN-032 NH2OH



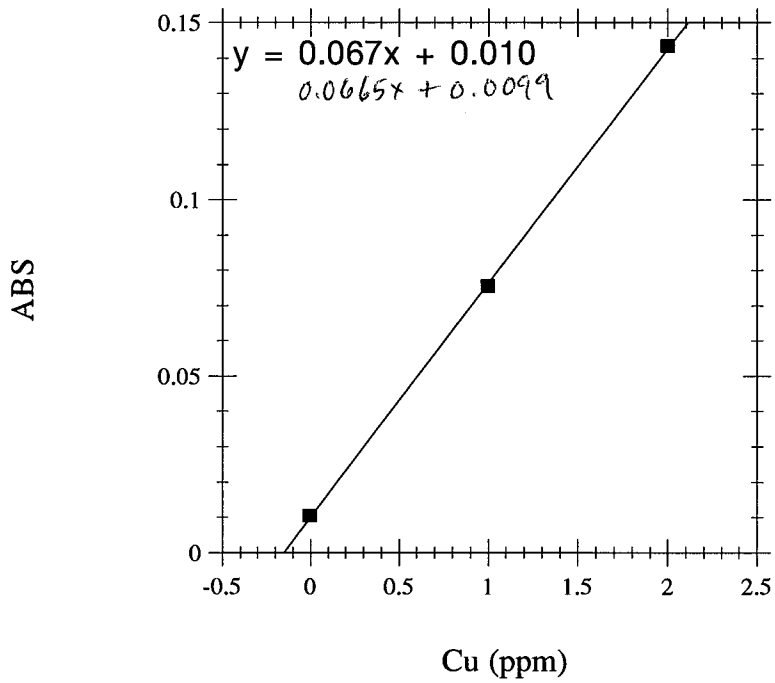
$.0454 \times 2 = .0908 \times \frac{8}{1.017} = .714$ ppm

SAN-033 NH2OH



$.0878 \times 2 = .1756 \times \frac{8}{1.012} = 1.388$ ppm

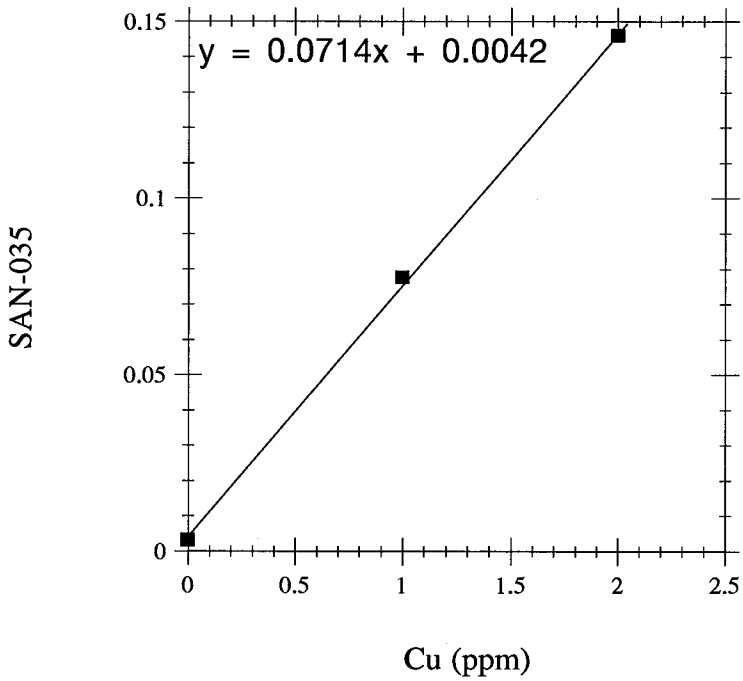
SAN-034 NH2OH



.1489
x2 = .2978

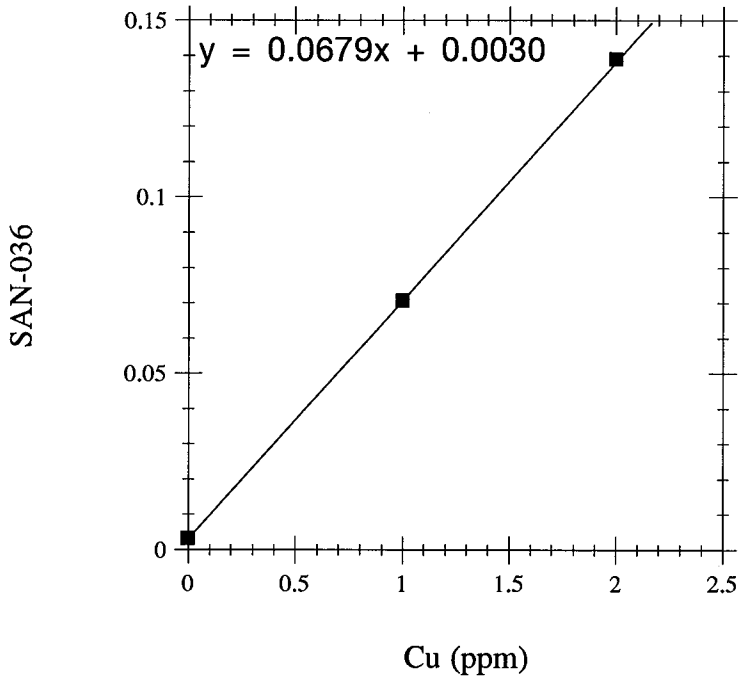
$.2978 \times \frac{8}{1.009} = 2.361 ppm$

SAN-035 NH2OH



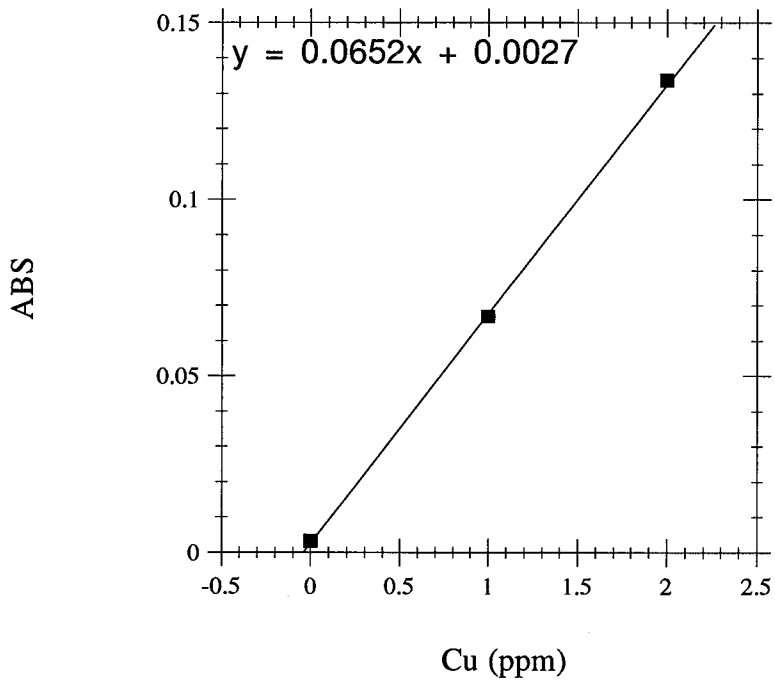
$.0588 \times 2 = .1176 \times \frac{8}{1.02} = .922 \text{ ppm}$

SAN-036 NH2OH



$.0442 \times 2 = .0884 \times \frac{8}{1.014} = .697$ ppm

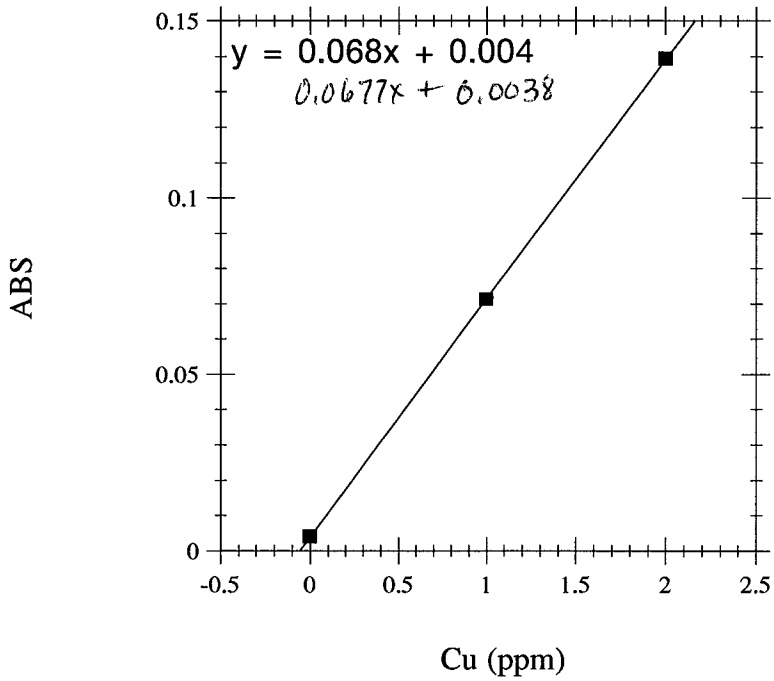
SAN-037 NH2OH



.0414 x 2 = .0828

.0828 x 8/1.021 = .649 ppm

SAN-038 NH2OH

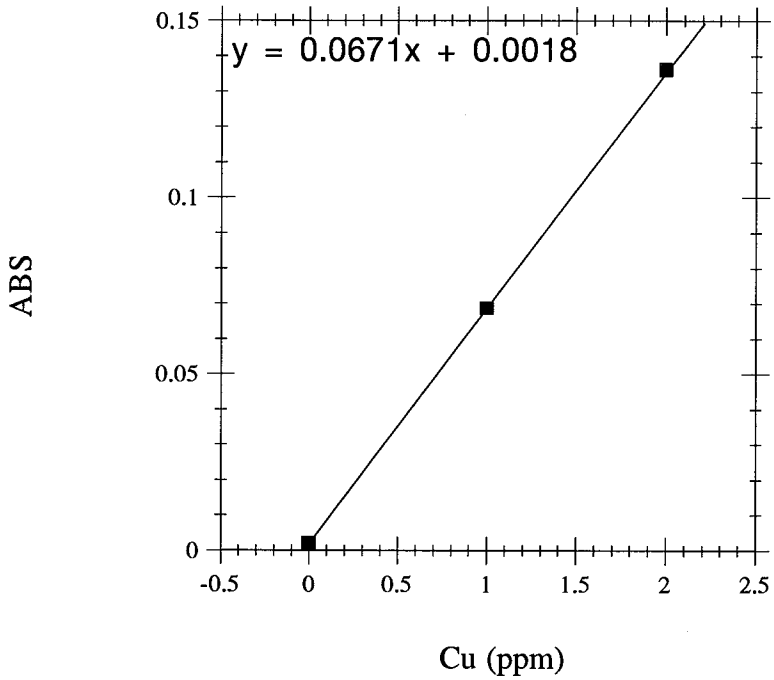


.0561

x2 = .1122

$.1122 \times \frac{8}{1.024} = .876$ ppm

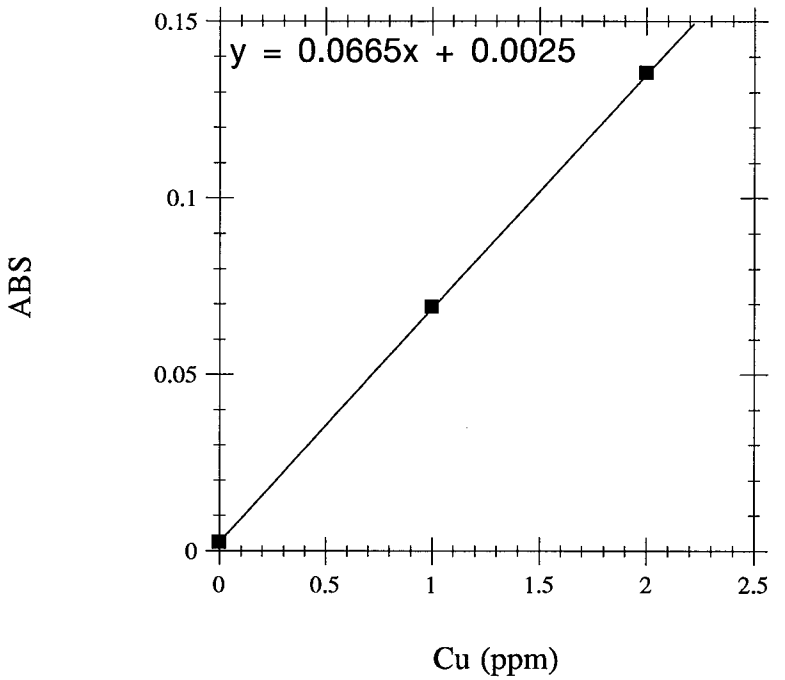
SAN-039 NH2OH



.0268 x 2 = .0536

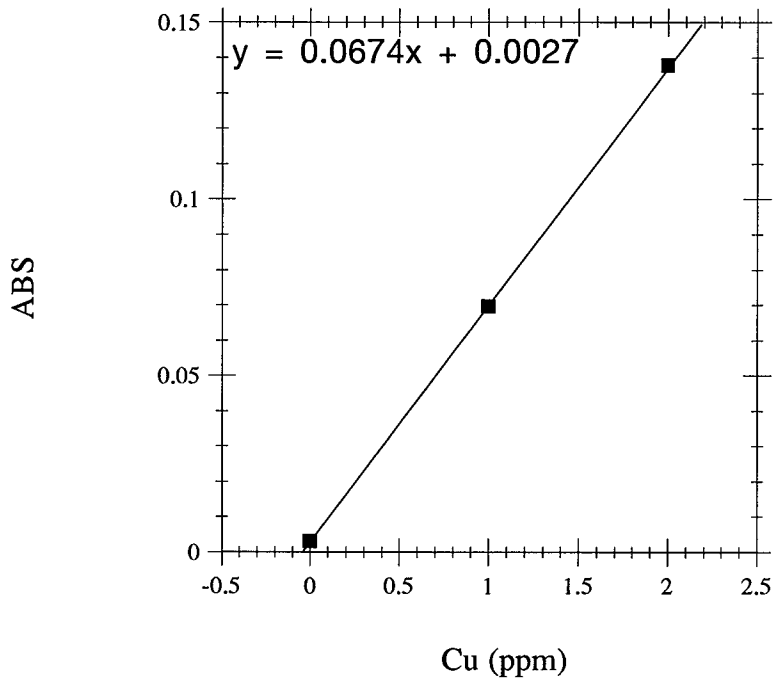
.0536 x 8 / 1.018 = .421 ppm

SAN-040 NH2OH



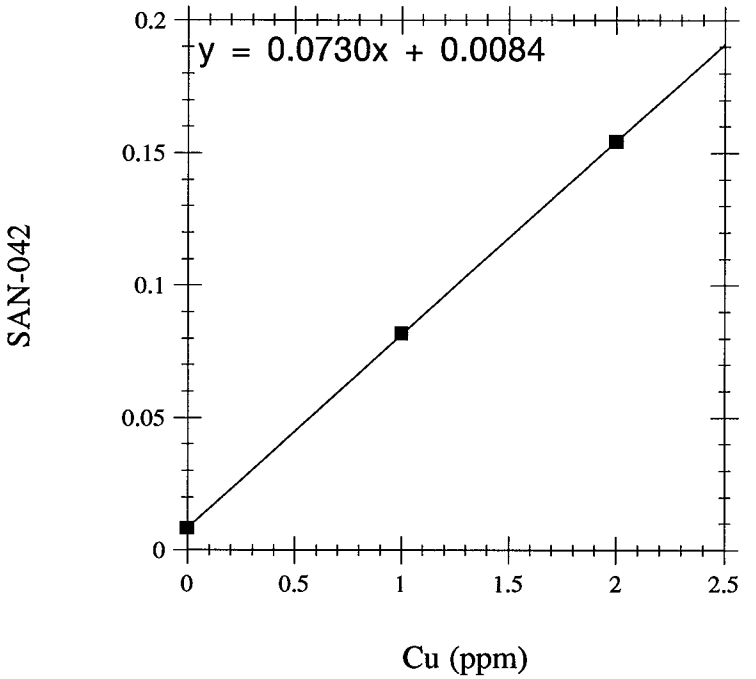
$.0376 \times 2 = .0752 \times \frac{8}{1.017} = .591 \text{ ppm}$

SAN-041 NH2OH



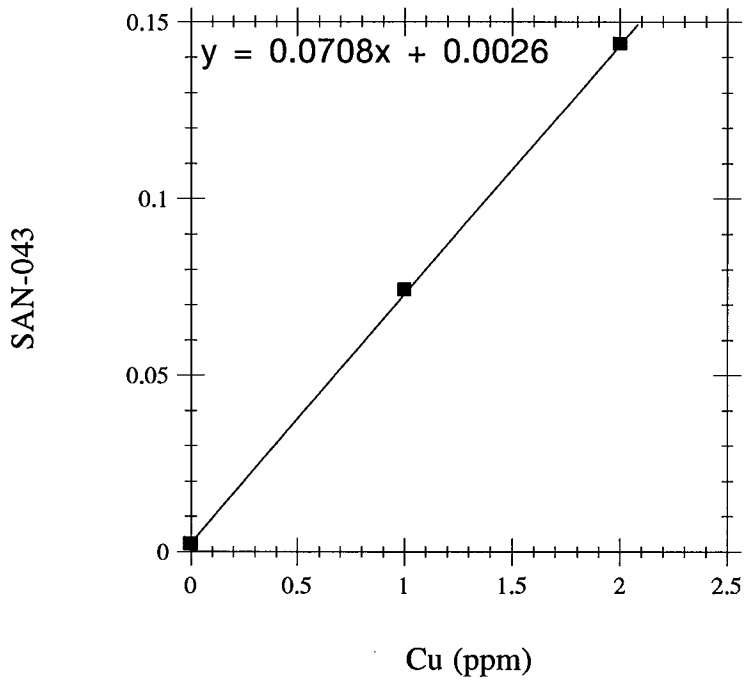
.0400 x2 = .0800 + 8/1.015 = .631 ppm

SAN-042 NH2OH



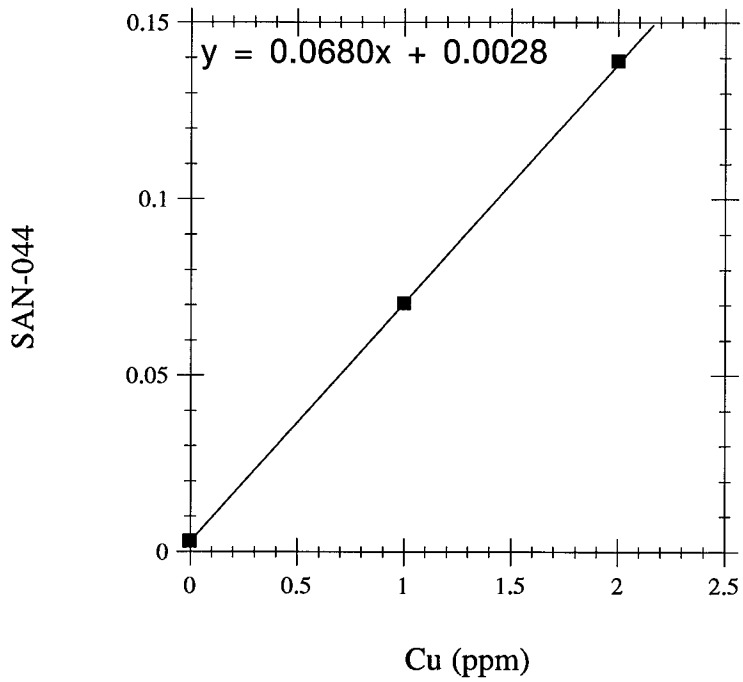
.11514 x 2 = .2302 x 8 / 1.012 = 1.8197 ppm

SAN-043 NH2OH



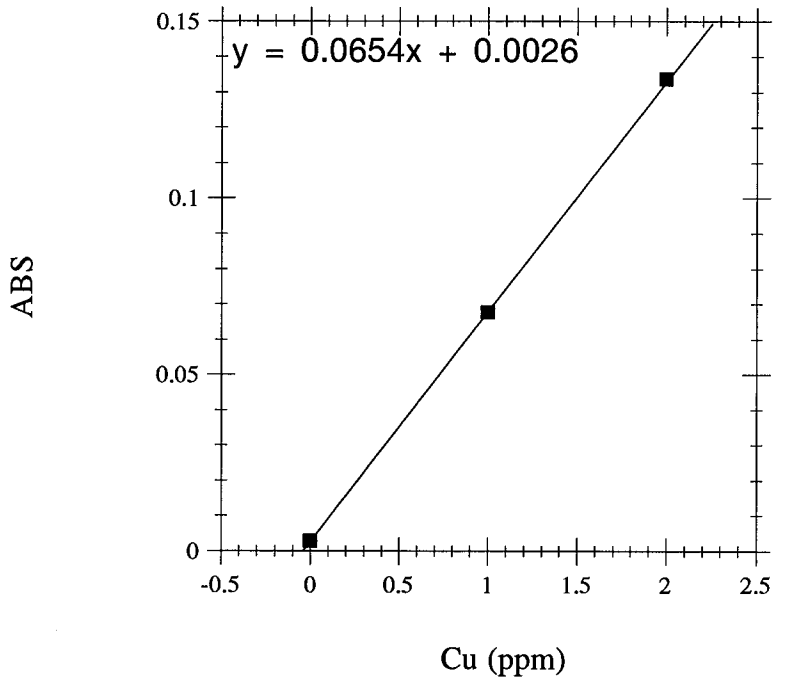
$.036742 = .0734 \times \frac{8}{1.022} = .574 ppm$

SAN-044 NH2OH



$.0412 \times 2 = .0824 \times \frac{8}{.014} = .65$ ppm

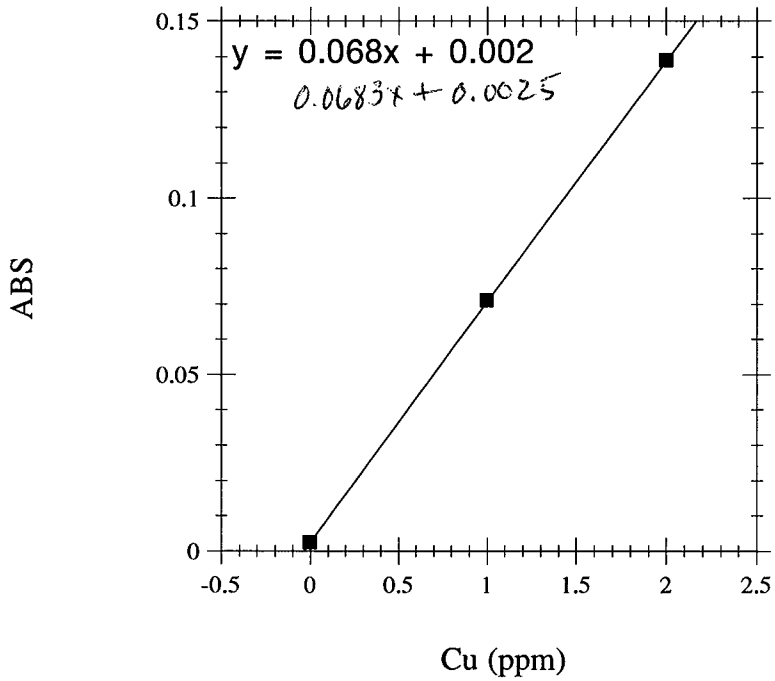
SAN-045 NH2OH



.0397 x 2 = .0794

.0794 x 8/1.017 = .625 ppm

SAN-046 NH2OH

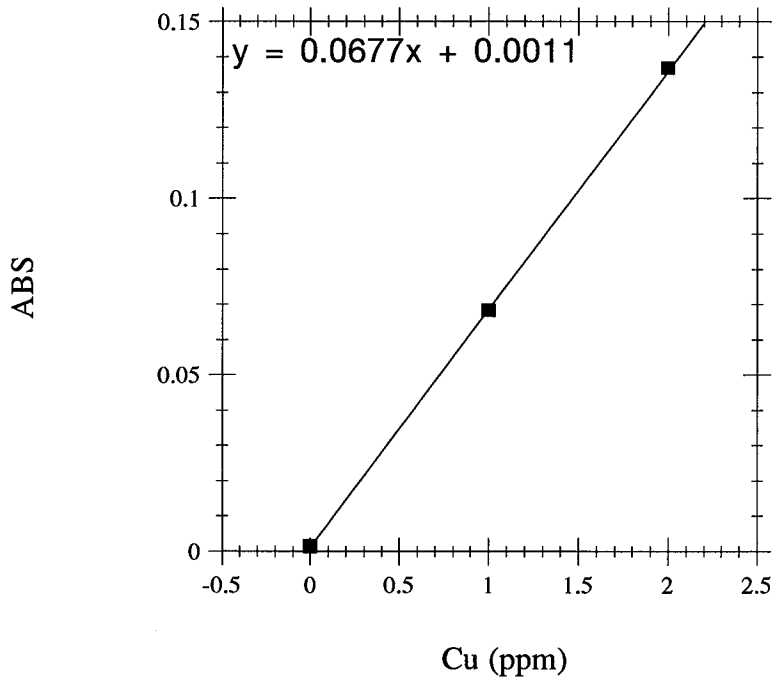


.0366

x2 = .0732

.0732 x 8/1.022 = .573 ppm

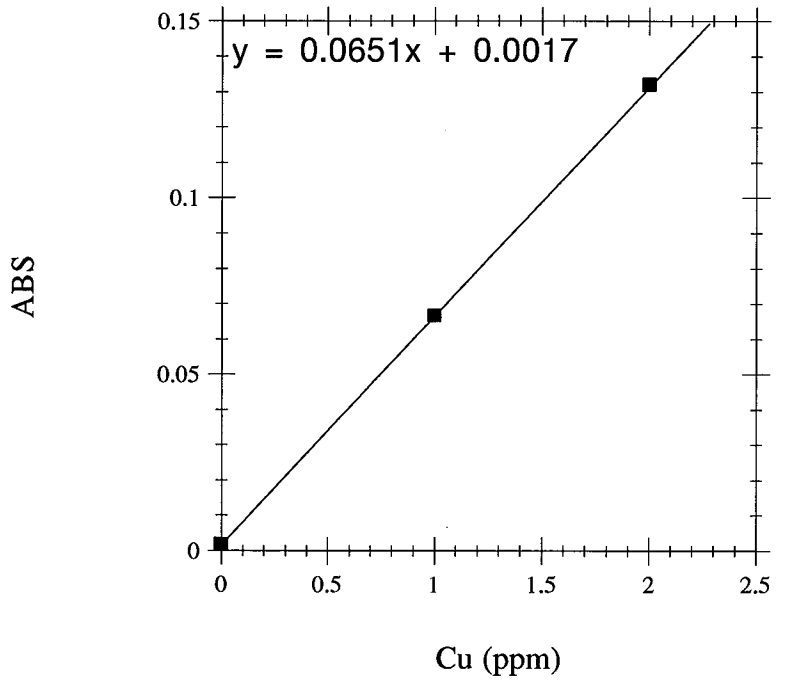
SAN-047 NH2OH



.0162 x 2 = .0324

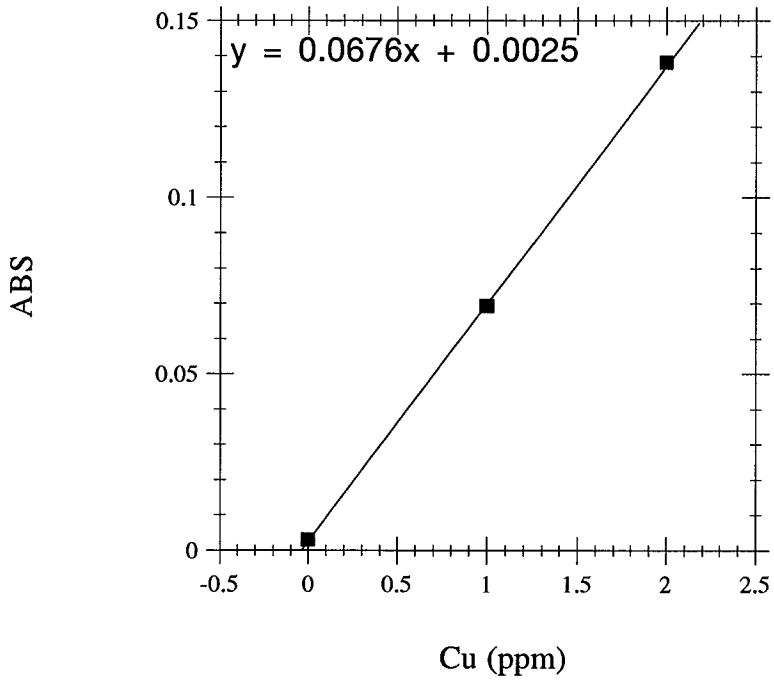
$\frac{.0324 \times 8}{1.023} = .253$ ppm

SAN-048 NH2OH



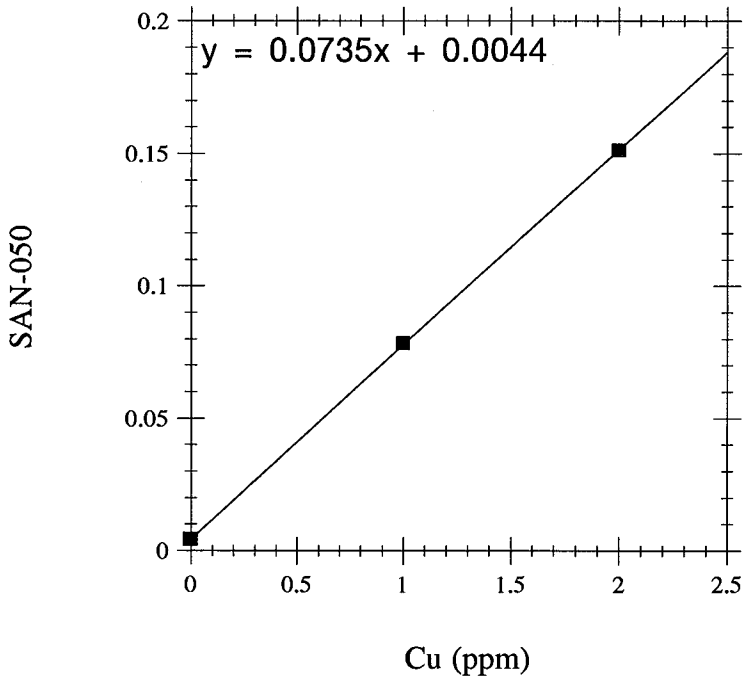
$.0261 \times 2 = .0522 + \frac{8}{1.022} = .409$ ppm

SAN-049 NH2OH



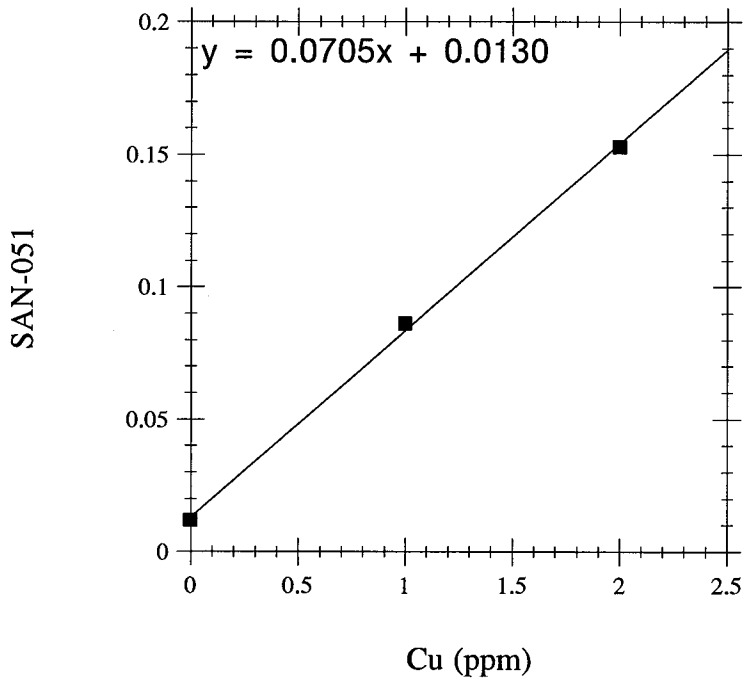
$.037 \times 2 = .074 \times \frac{8}{1.017} = .582$ ppm

SAN-050 NH2OH



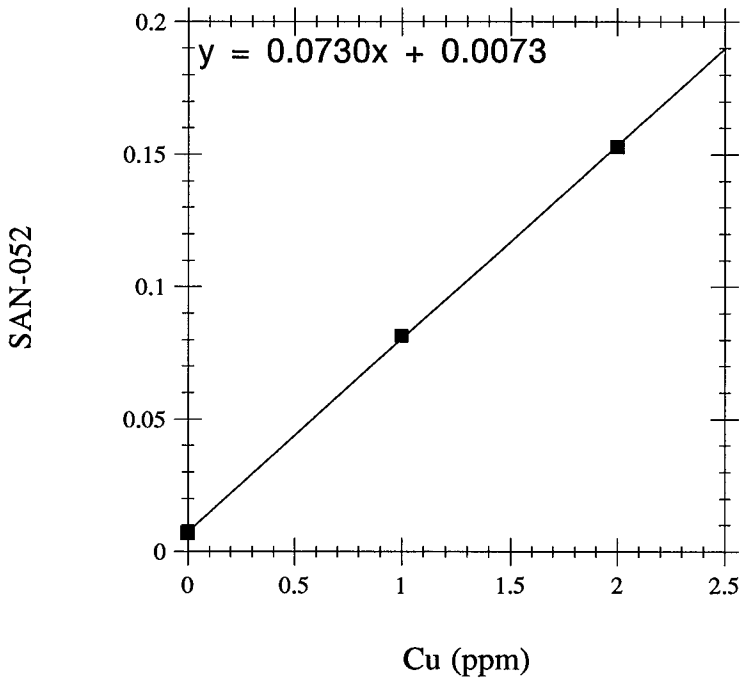
.0599x2= .1198 x 8/1.026 = .943 ppm

SAN-051 NH2OH



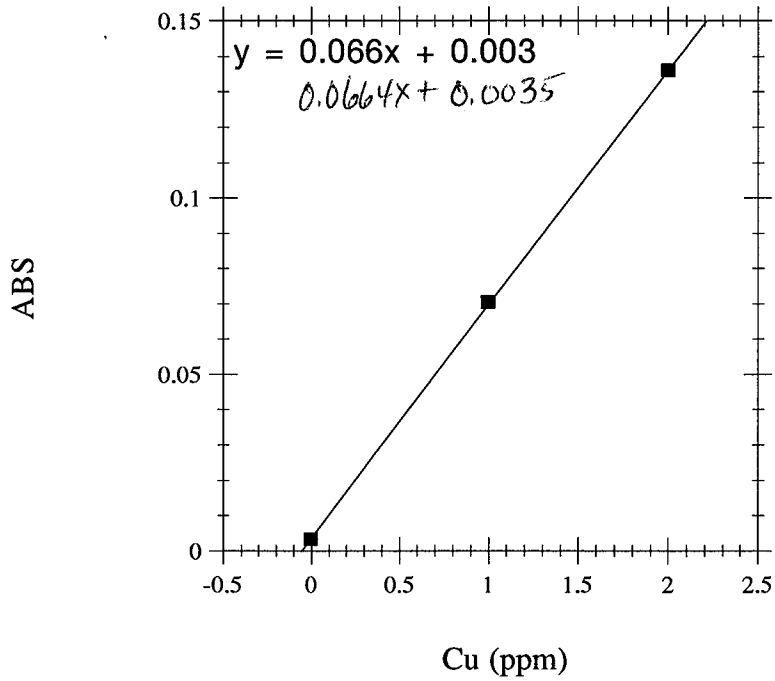
.1844 x2 = .3688 x 8/1.017 = 2.901 ppm

SAN-052 NH2OH



$.1 \times 2 = .2 + \frac{8}{1.02} = 1.568$ ppm

SAN-053 NH2OH



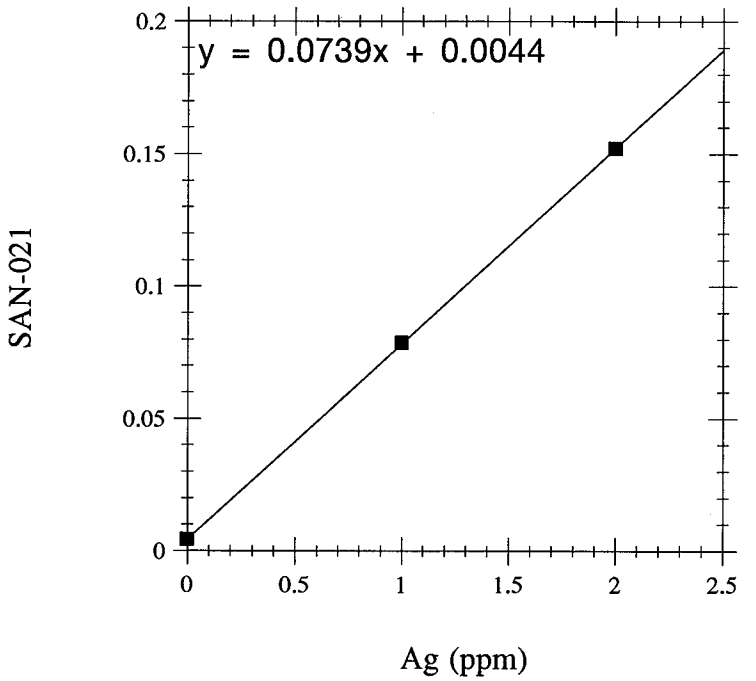
.0527

x2 = .1054

$.1054 \times \frac{8}{1.008} = .836$ ppm

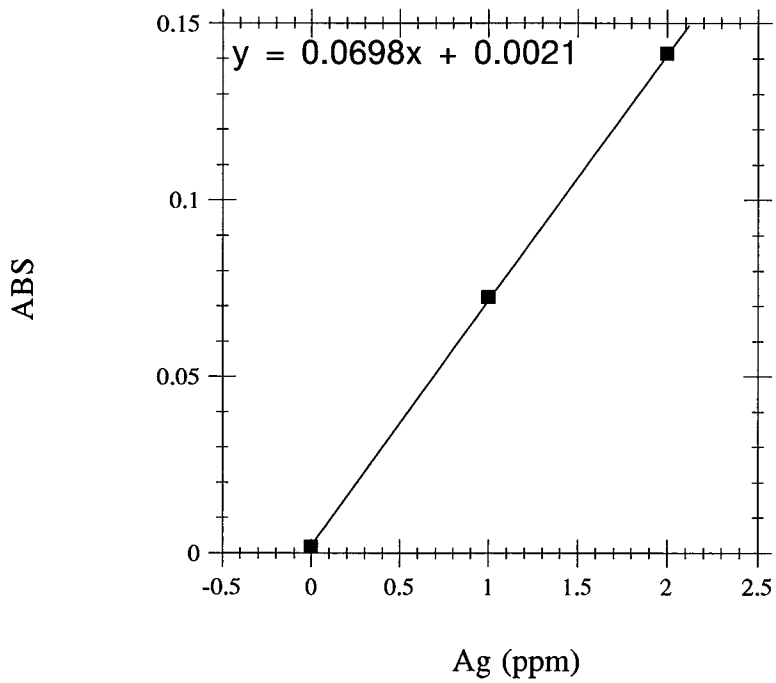
Ag data

SAN-021 MgCl2



.0595 x 2 = .119 x 8/1.0 = .937 ppm

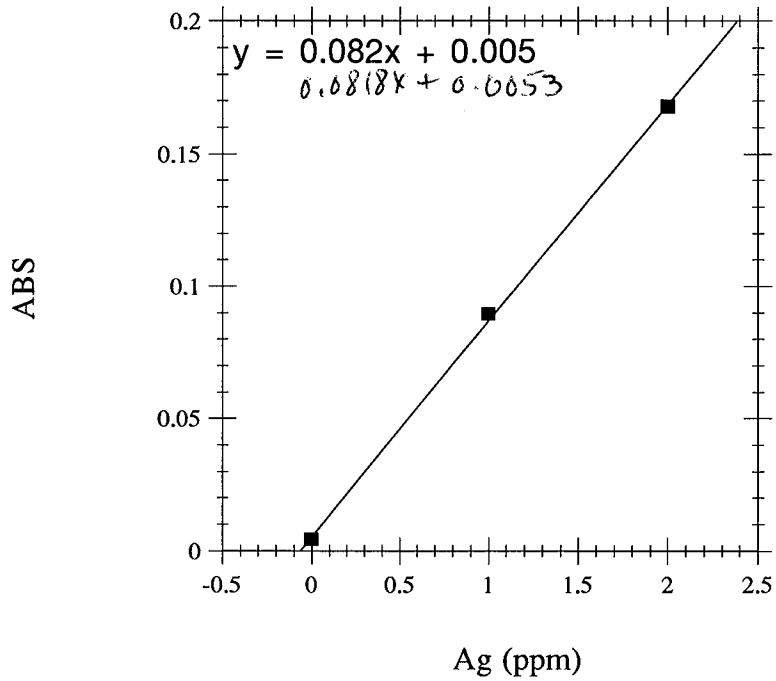
SAN-022 MgCl2



.0300 x 2 = .0600

.0600 x 8/1.022 = .4697 ppm

SAN-023 MgCl2

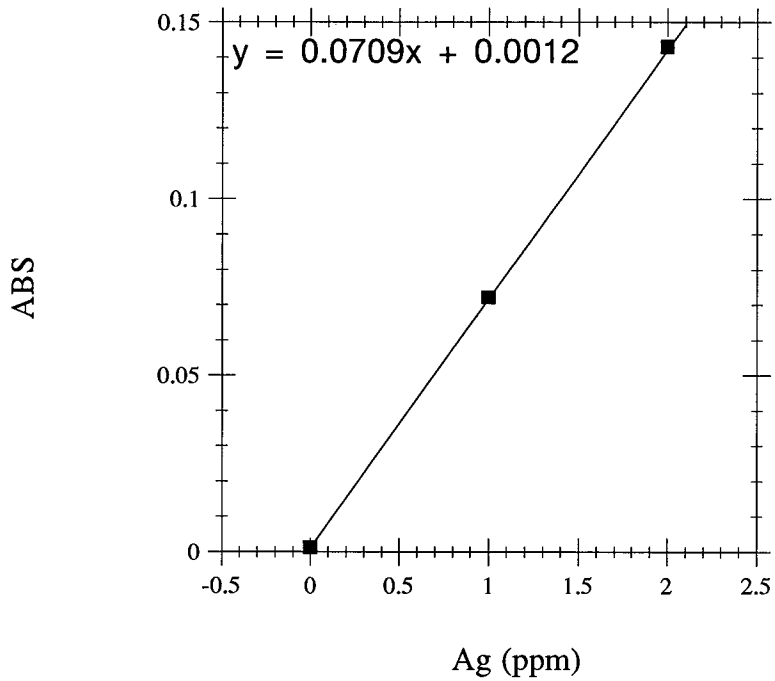


.0648

x2 = .1296

$.1296 \times \frac{8}{1.022} = \underline{1.014 \text{ ppm}}$

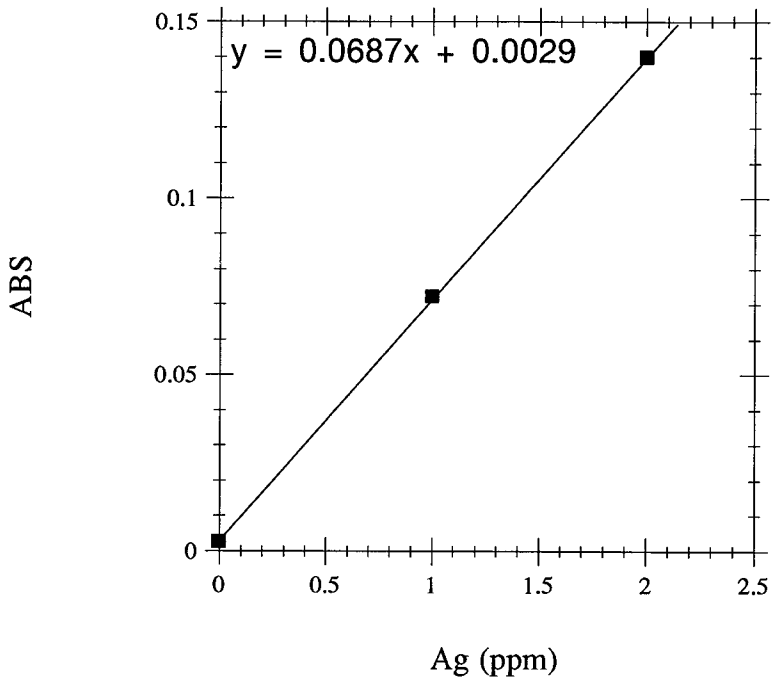
SAN-024 MgCl2



.0169 x 2 = .0338

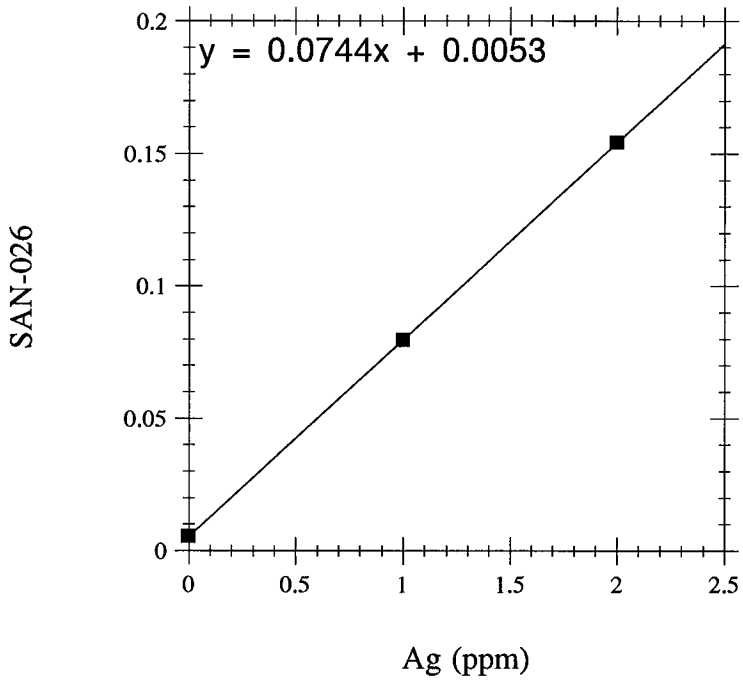
.0338 x 8/1.018 = .266 ppm

SAN-025 MgCl2



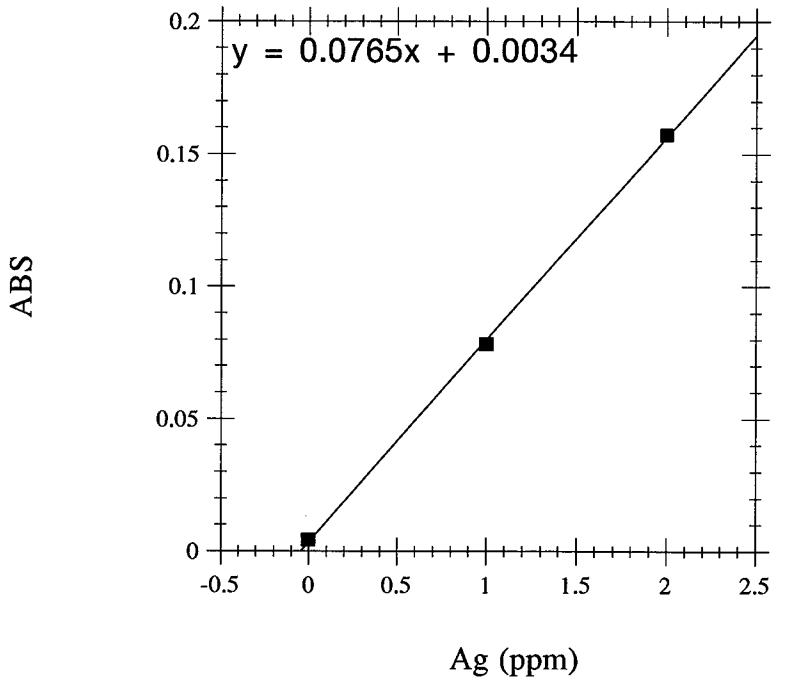
$.0422 \times 2 = .0844 \times \frac{8}{1.025} = .659$ ppm

SAN-026 MgCl2



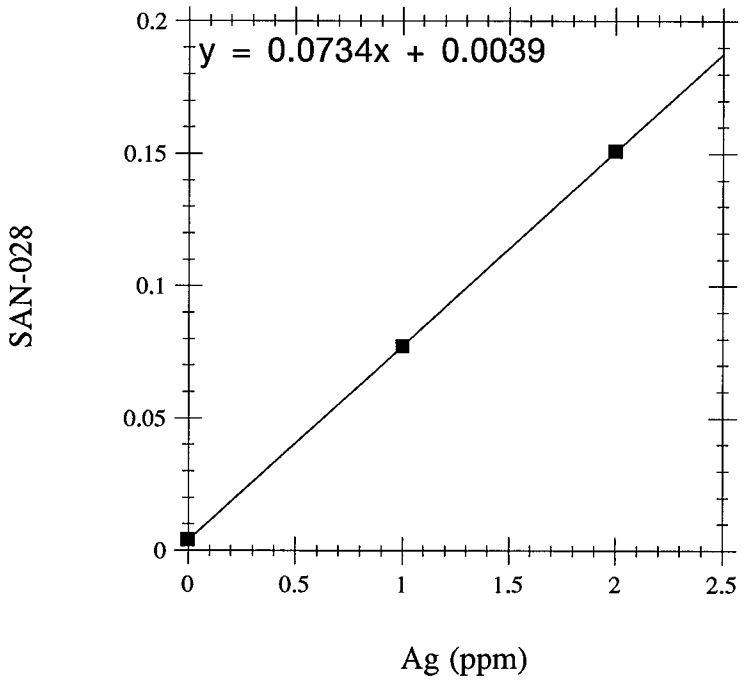
.0712 x 2 = .1424 x 8/1.021 = 1.116 ppm

SAN-027 MgCl2



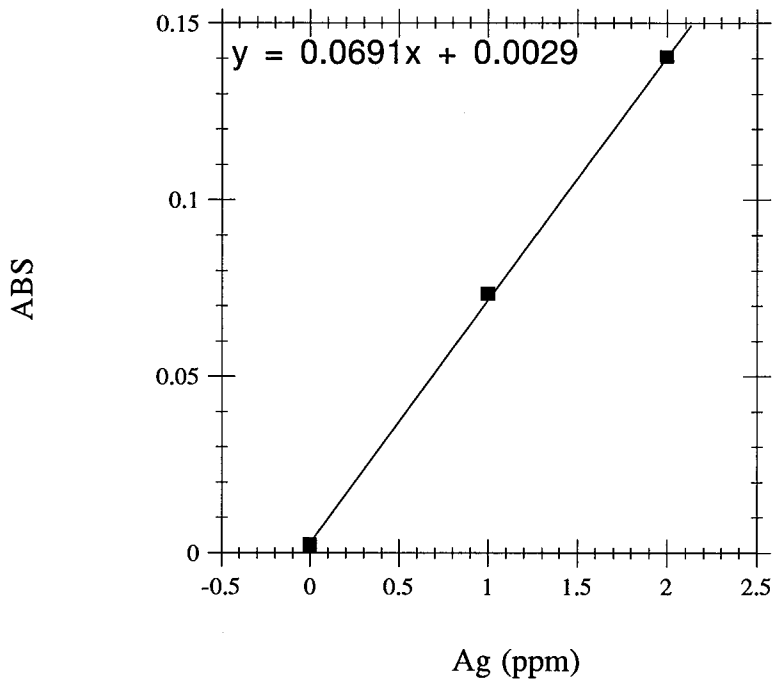
.0444 x 2 = .0888 + 8/1.013 = .701 ppm

SAN-028 MgCl2



.0531x2 = .1062 x 8 / .023 = .830ppm

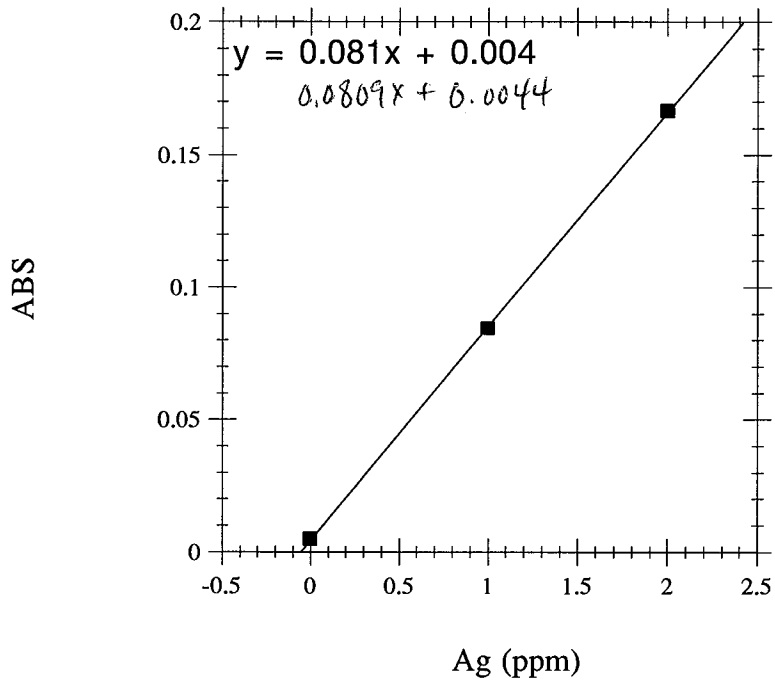
SAN-029 MgCl2



.0420 x 2 = .084

.084 x 8 / 1.020 = .659ppm

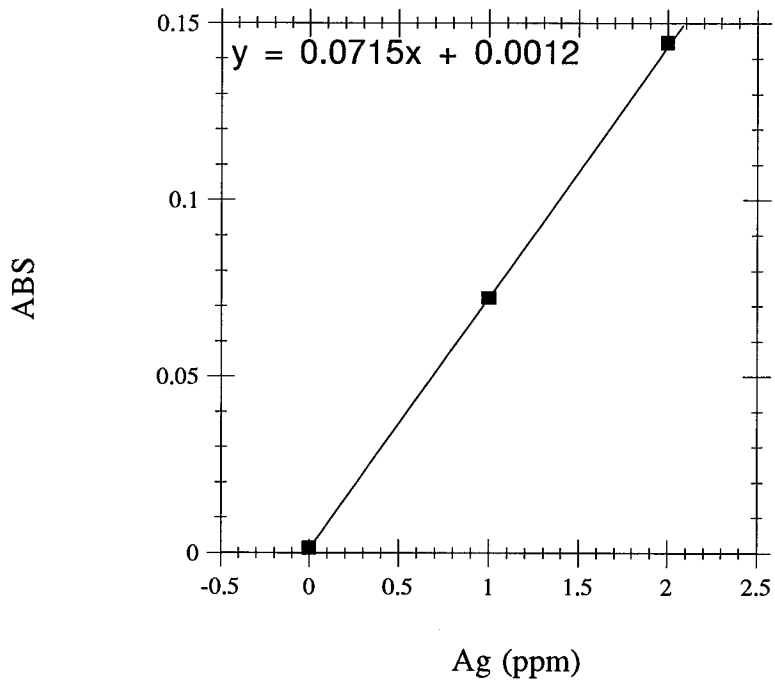
SAN-030 MgCl2



.0544 x 2 = .1088

$.1088 \times \frac{8}{1.022} = .852$ ppm

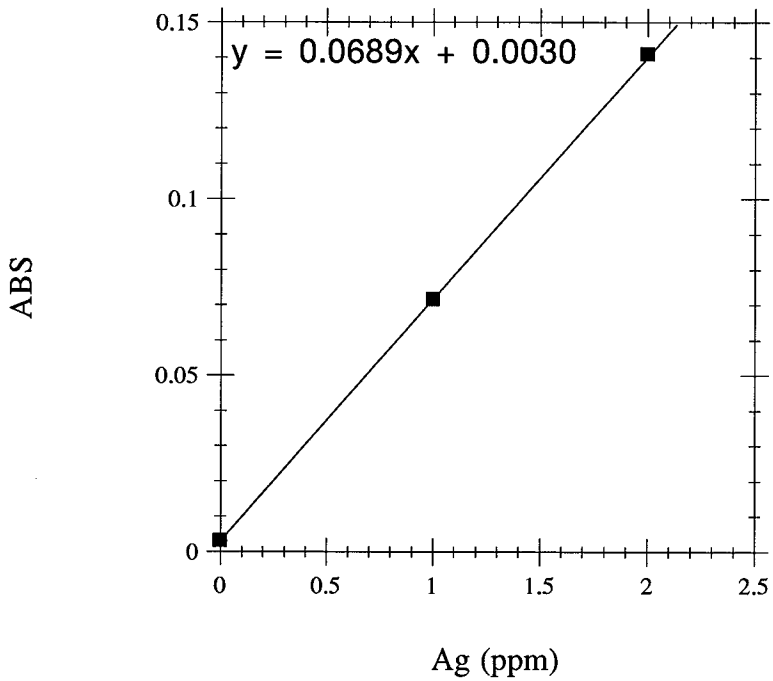
SAN-031 MgCl2



.0168 x 2 = .0336

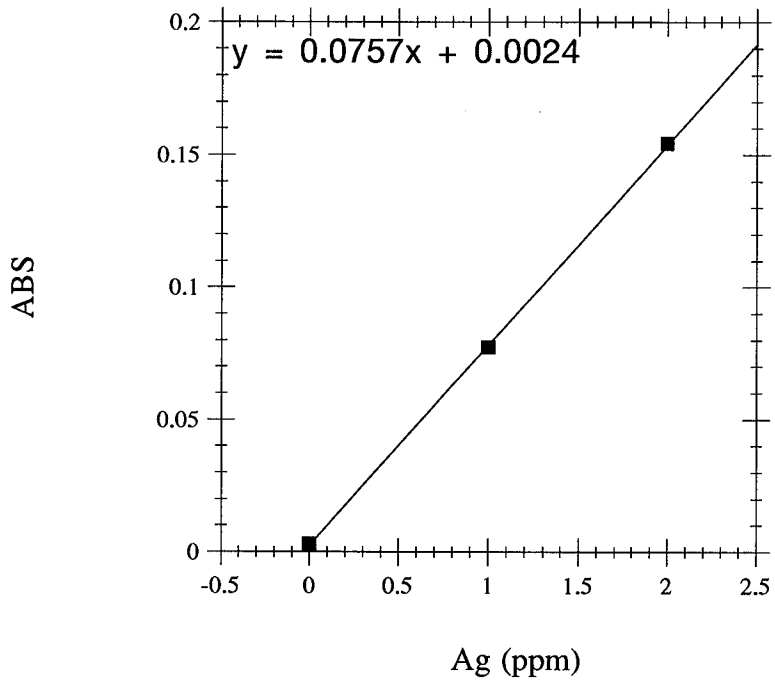
$\frac{.0336 \times 8}{1.026}$ = .262 ppm

SAN-032 MgCl2



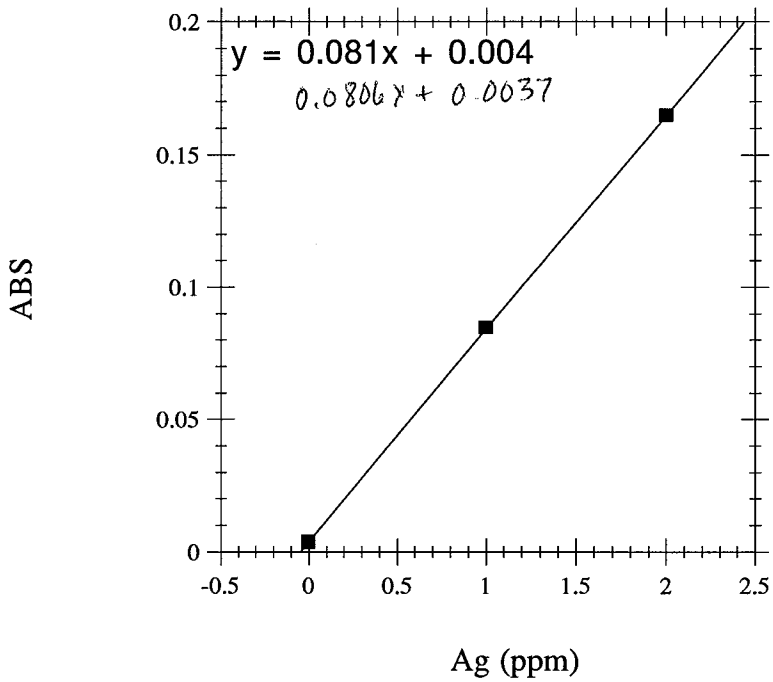
$.0435 \times 2 = .087 \times \frac{8}{1.017} = .684$ ppm

SAN-033 MgCl2



.0317 x 2 = .0634 x 8/1.012 = .501 ppm

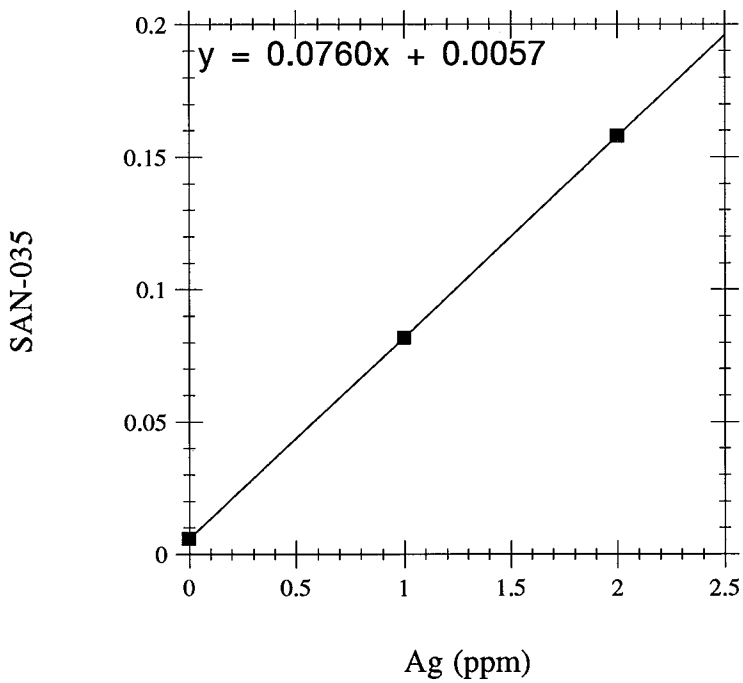
SAN-034 MgCl2



.0459 x 2 = .0918

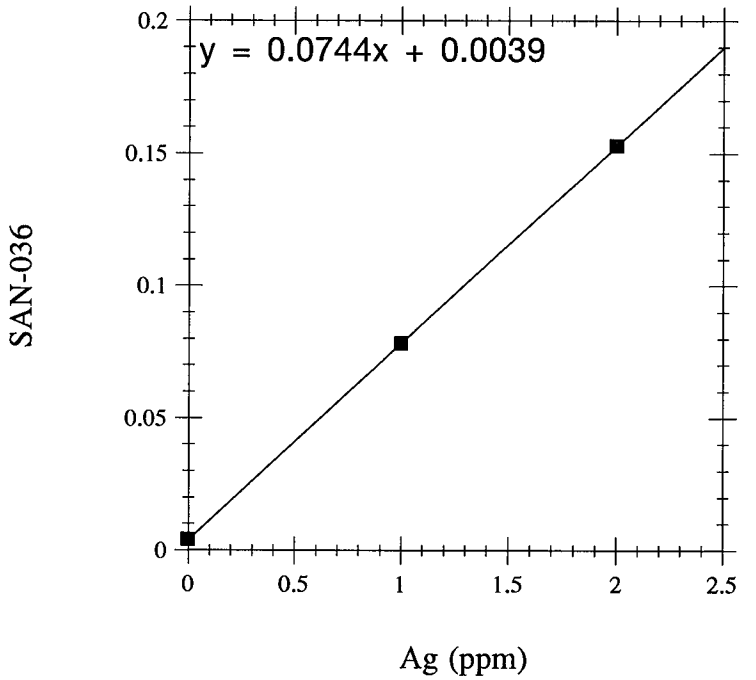
$\frac{.0918 \times 8}{1.009} = .728$ ppm

SAN-035 MgCl2



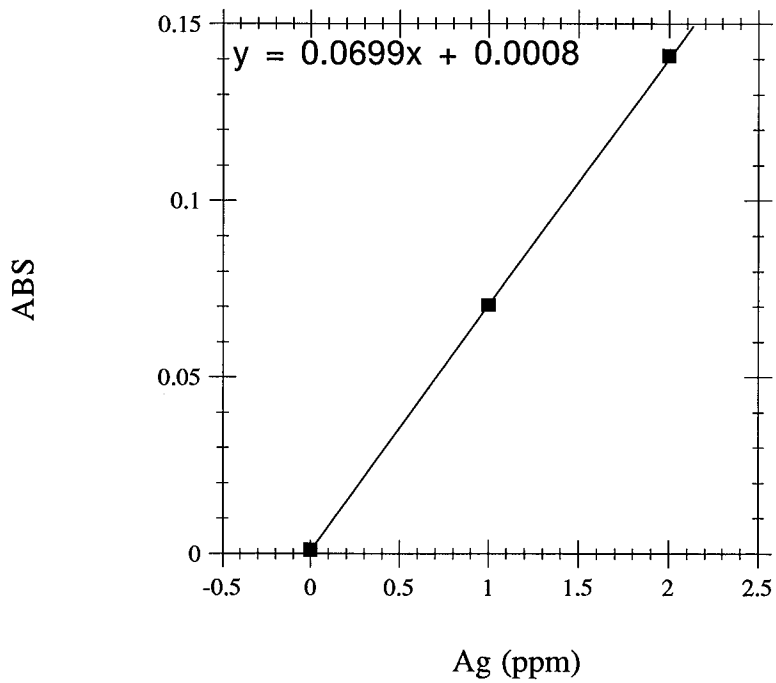
.075 x 2 = .150 x 8/1.02 = 1.176 ppm

SAN-036 MgCl2



.0524 x 2 = .1048 x 8/1.014 = .827 ppm

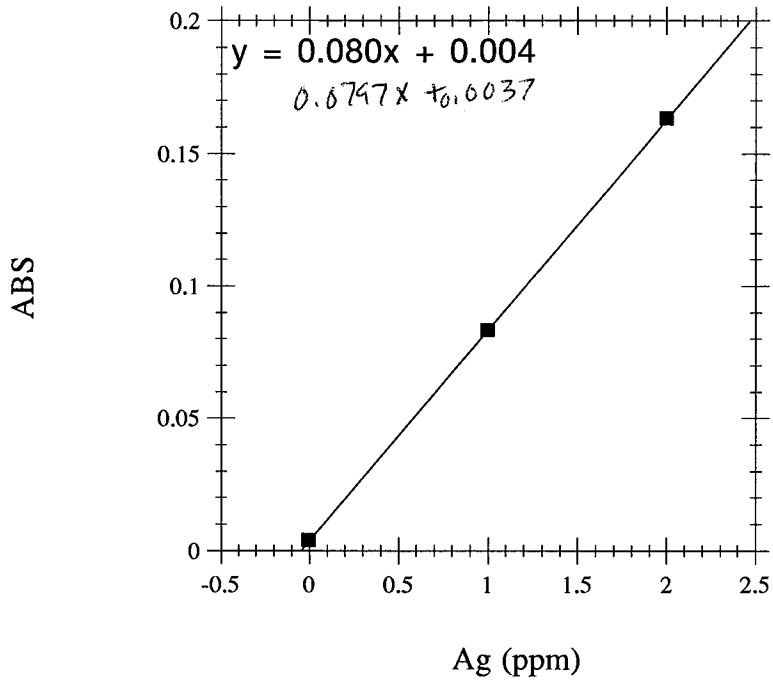
SAN-037 MgCl2



.0114 x 2 = .0228

.0228 x 8 / 1.021 = .179 ppm

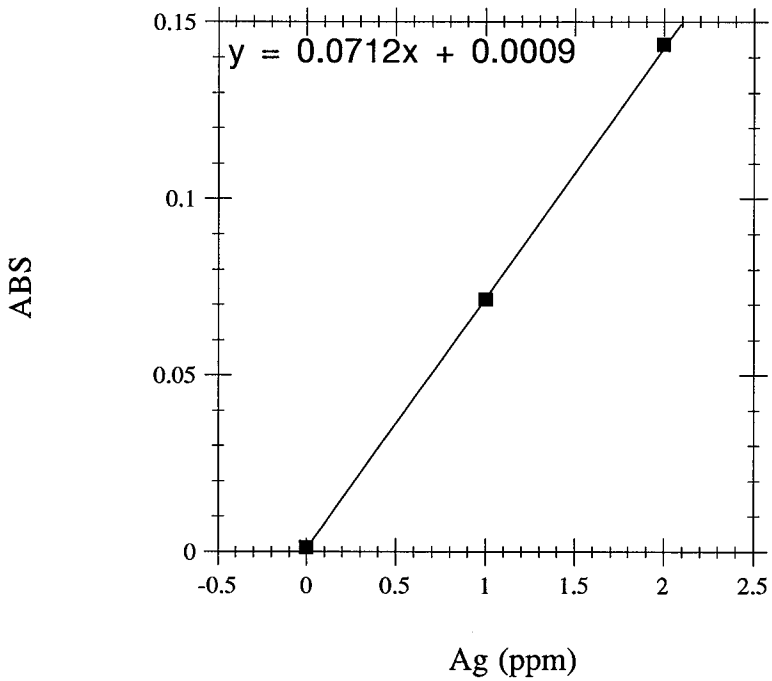
SAN-038 MgCl2



.0444 x2 = .0928

.0928 x 8/1.024 = .725 ppm

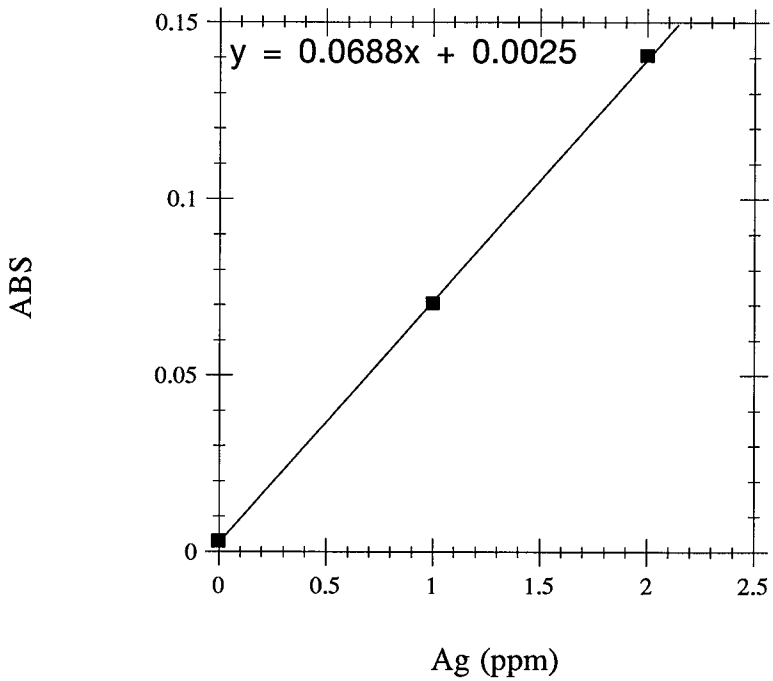
SAN-039 MgCl2



.0126 x 2 = .0252

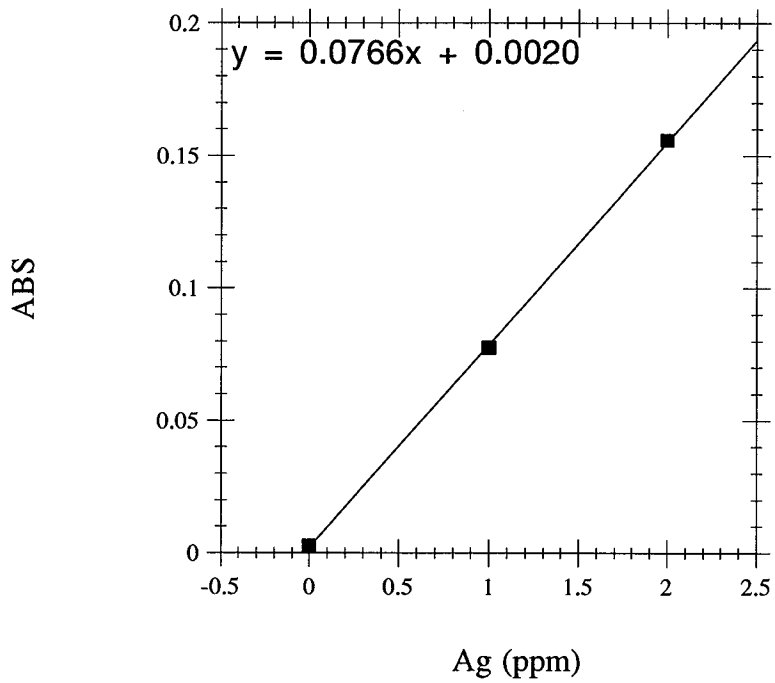
$\frac{.0252 + 8}{1.018}$ = .198 ppm

SAN-040 MgCl2



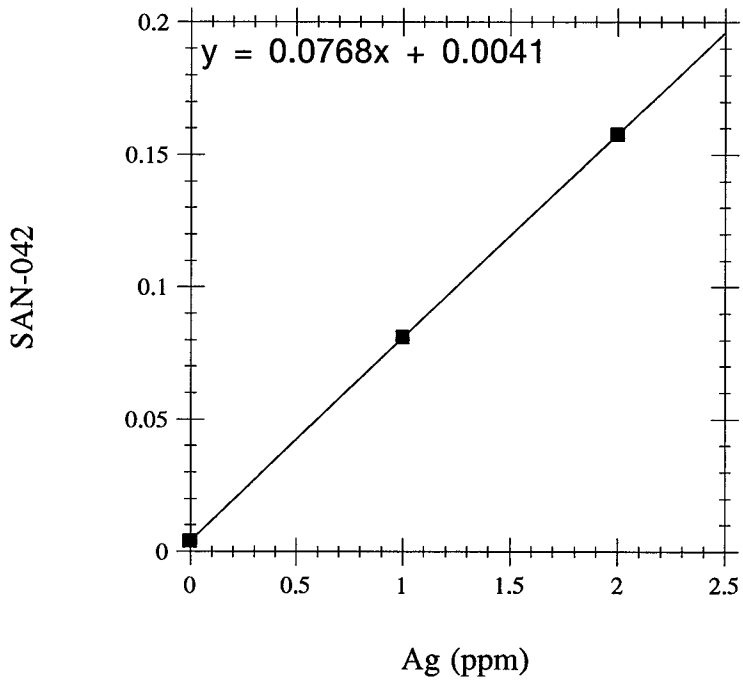
$.0363 \times 2 = .0726 \times \frac{8}{1.017} = .571$ ppm

SAN-041 MgCl2



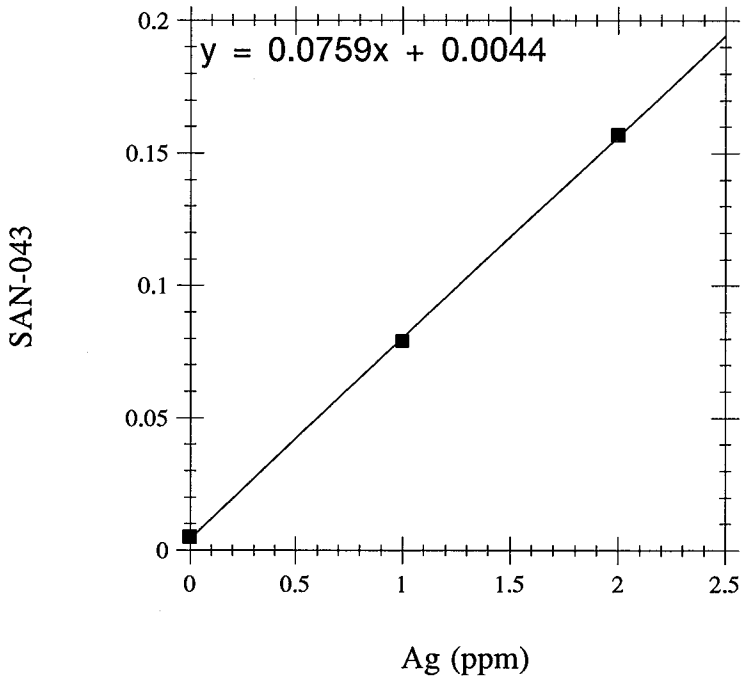
.0261 x 2 = .0522 x 8/1.015 = .411 ppm

SAN-042 MgCl2



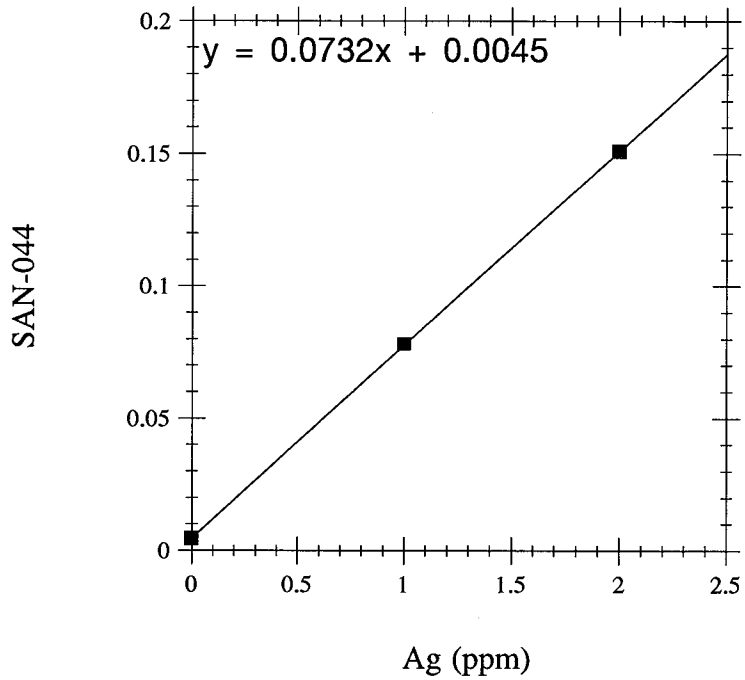
$.0534 \times 2 = .1068 \times \frac{8}{1.012} = .844$ ppm

SAN-043 MgCl2



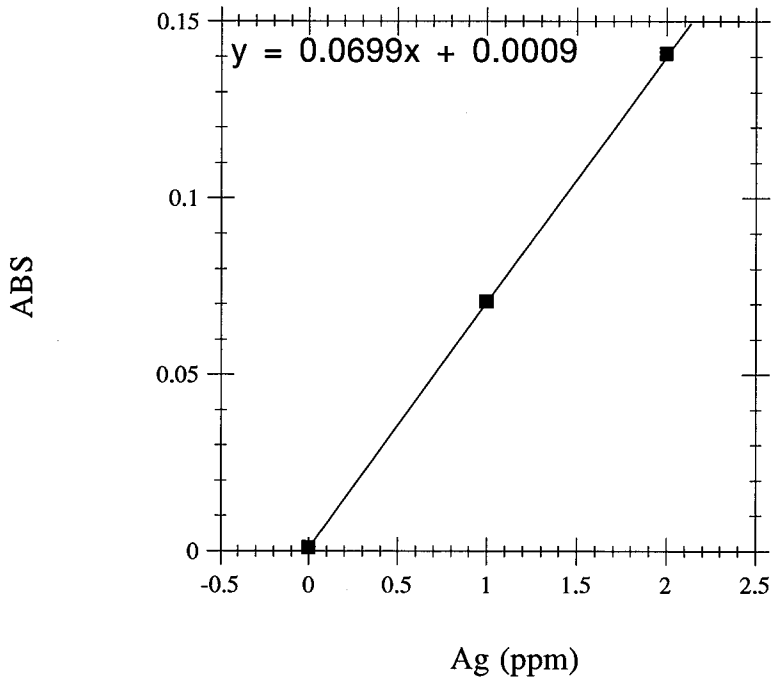
.05797 x 2 = .11594 x 8/1.022 = .907 ppm

SAN-044 MgCl2



.0615 x 2 = .123 x 8 / 1.014 = .970 ppm

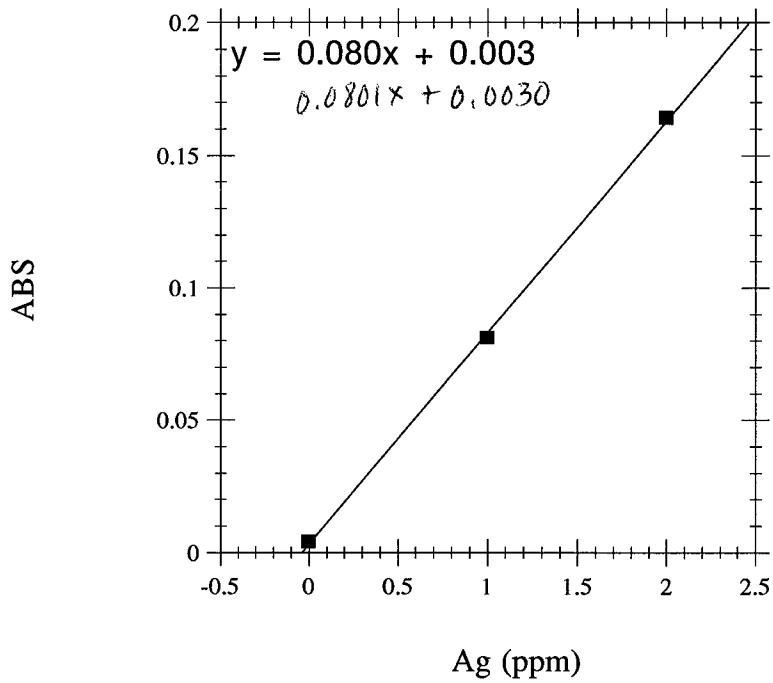
SAN-045 MgCl2



.0129 x 2 = .0258

.0258 x 8/1.017 = .203 ppm

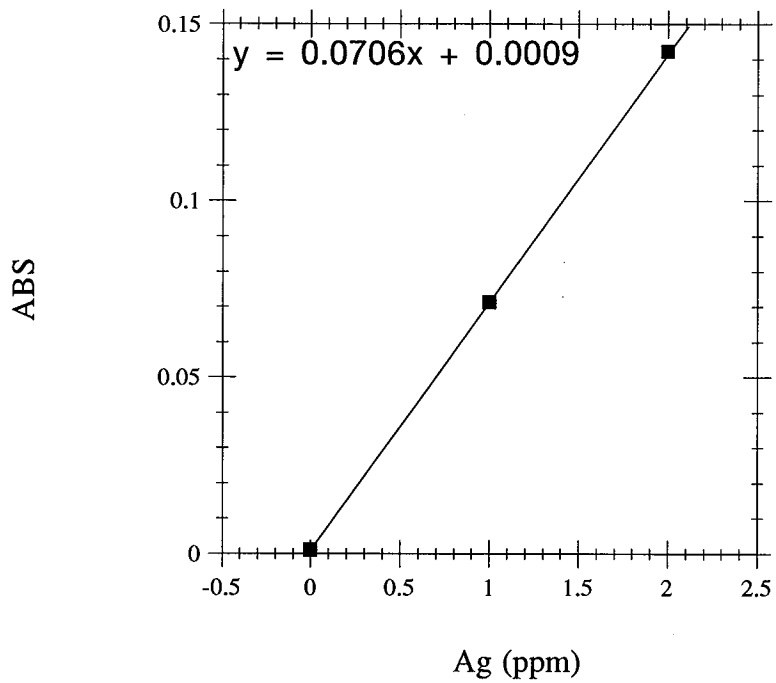
SAN-046 MgCl2



.0374 x 2 = .0748

$\frac{.0748 \times 8}{1.022}$ = .585 ppm

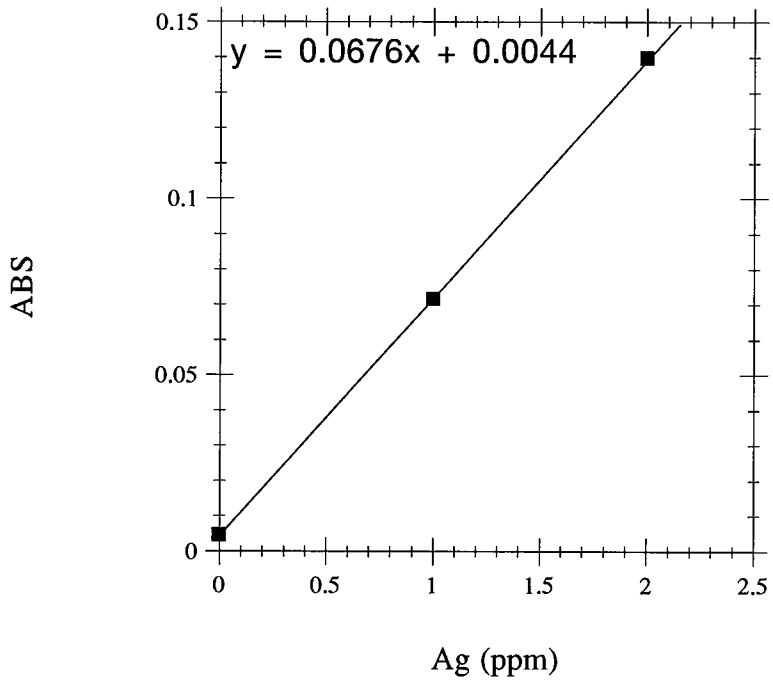
SAN-047 MgCl2



.0127 × 2 = .0254

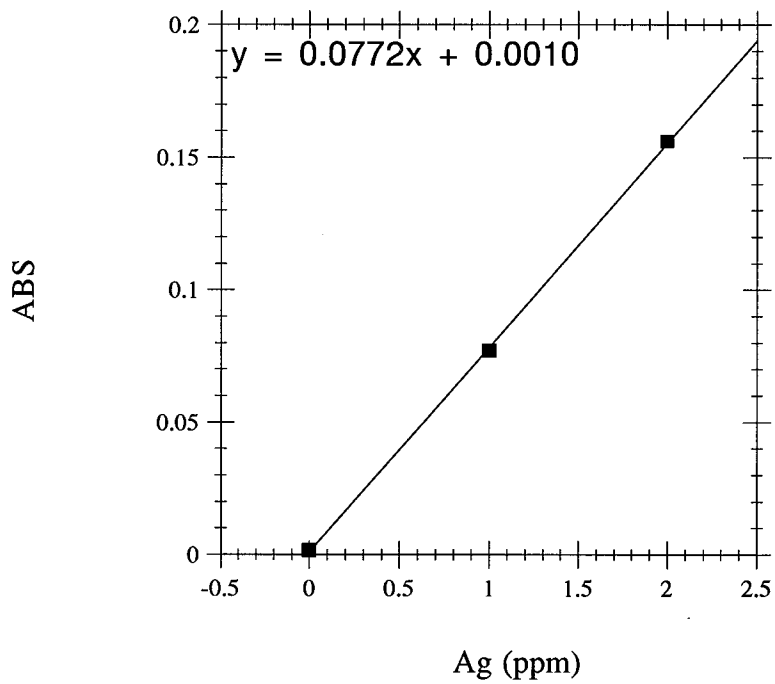
.0254 × 8/1.023 = .199 ppm

SAN-048 MgCl2



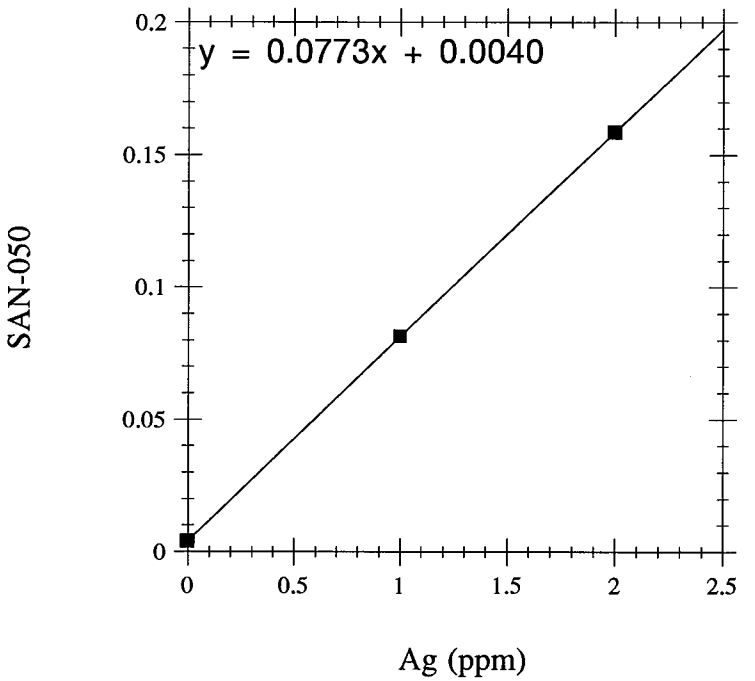
$.0651 \times 2 = .1302 \times \frac{8}{1.022} = 1.019$ ppm

SAN-049 MgCl2



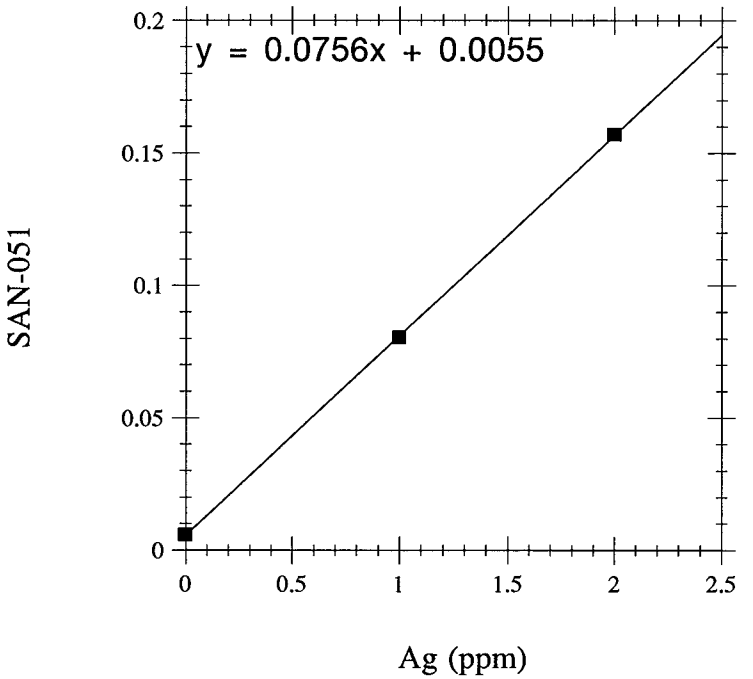
.01295 x2 = .0259 x 8/1.017 = .204ppm

SAN-050 MgCl2



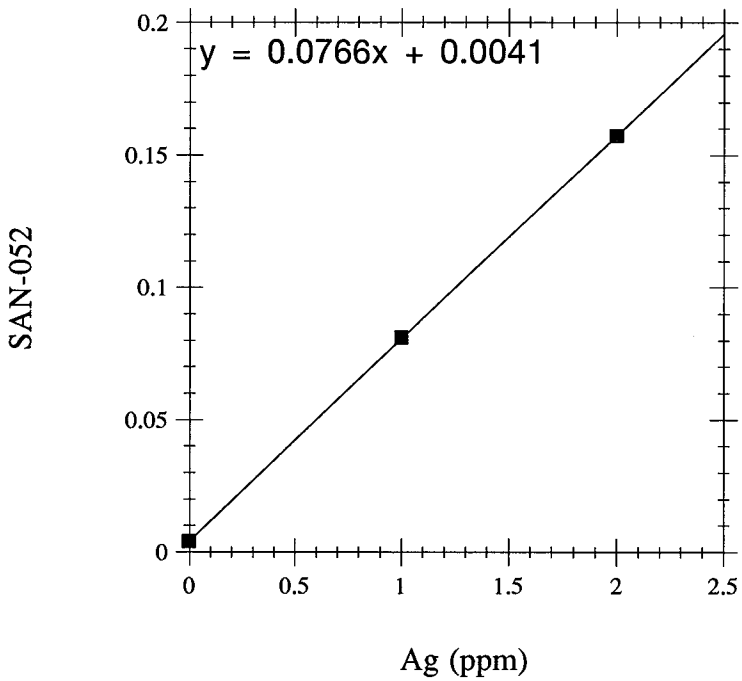
$.0517 \times 2 = .1034 \times \frac{8}{1.016} = .814$ ppm

SAN-051 MgCl2



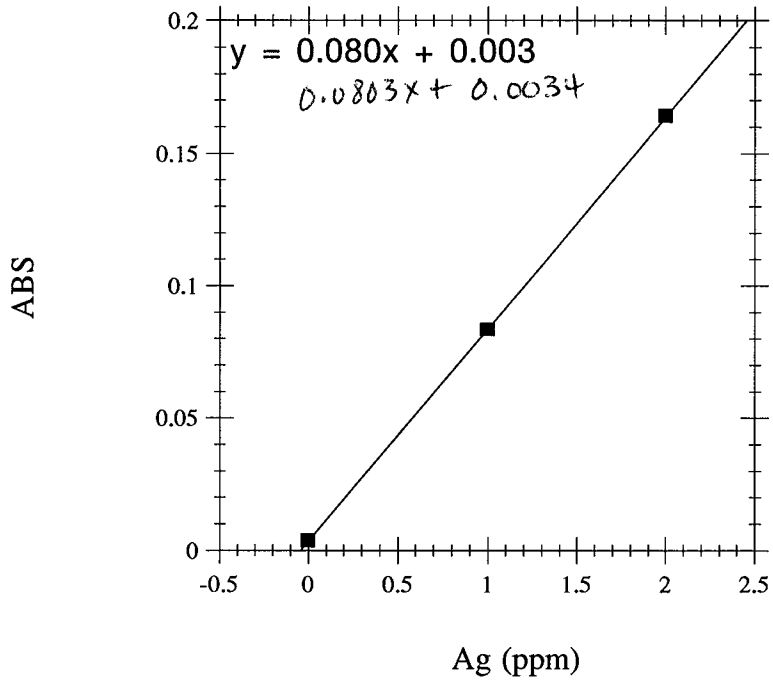
.0727 x 2 = .1454 x 8 / 1.017 = 1.144 ppm

SAN-052 MgCl2



$.0535 \times 2 = .107 \times \frac{8}{1.02} = .839$ ppm

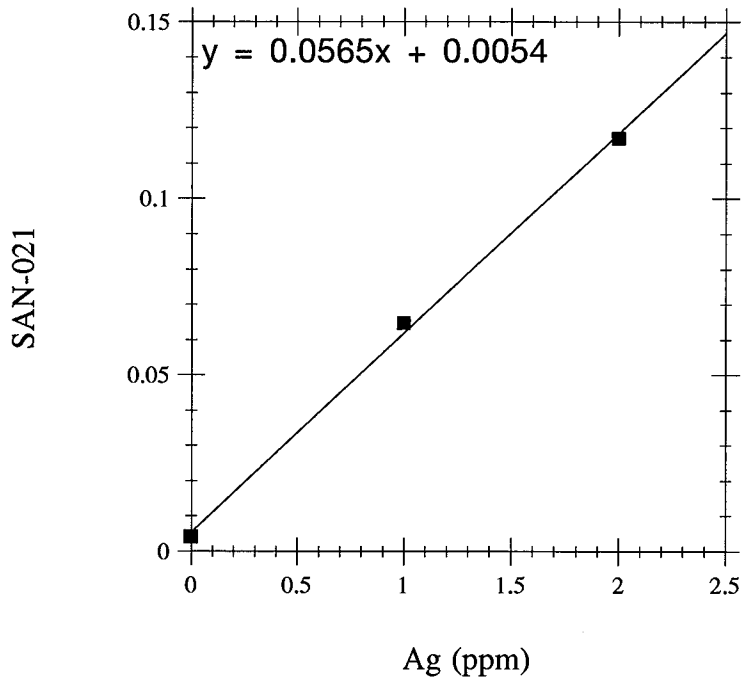
SAN-053 MgCl2



.0423 × 2 = .0846

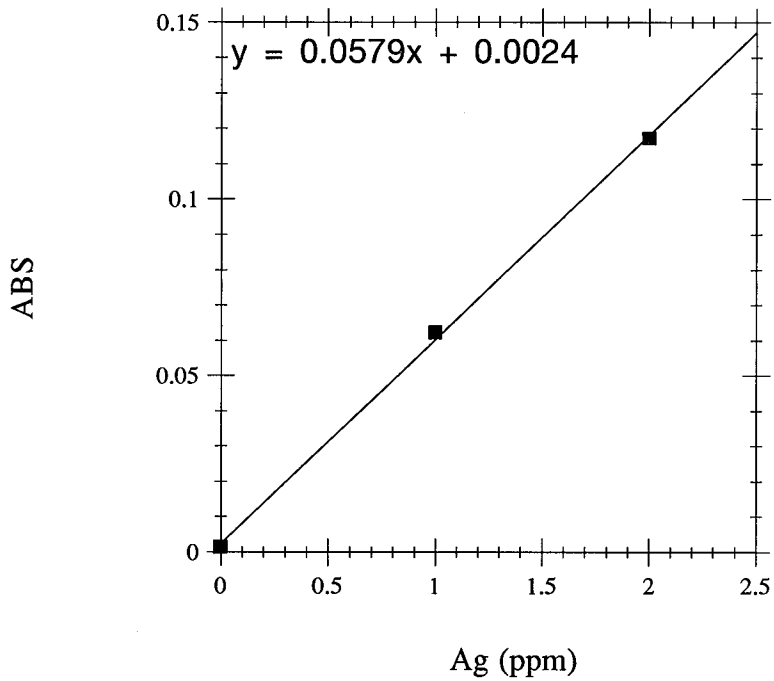
$.0846 \times \frac{8}{1.008} = .671$ ppm

SAN-021 NaOAc



.0956 x 2 = .1912 x 8/1.016 = 1.505 ppm

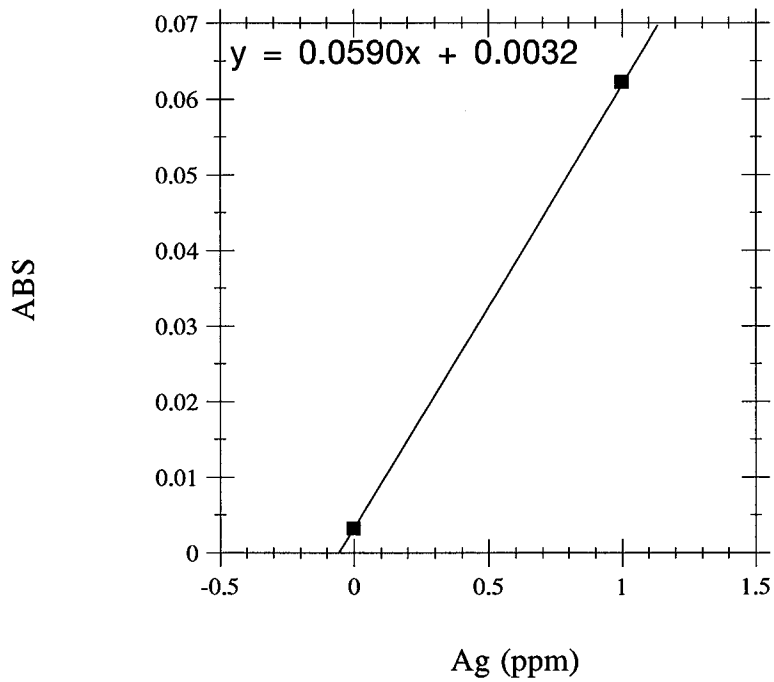
SAN-022 NaOAc



.0415 x 2 = .0830

$.0830 \times \frac{8}{1.022} = .650$ ppm

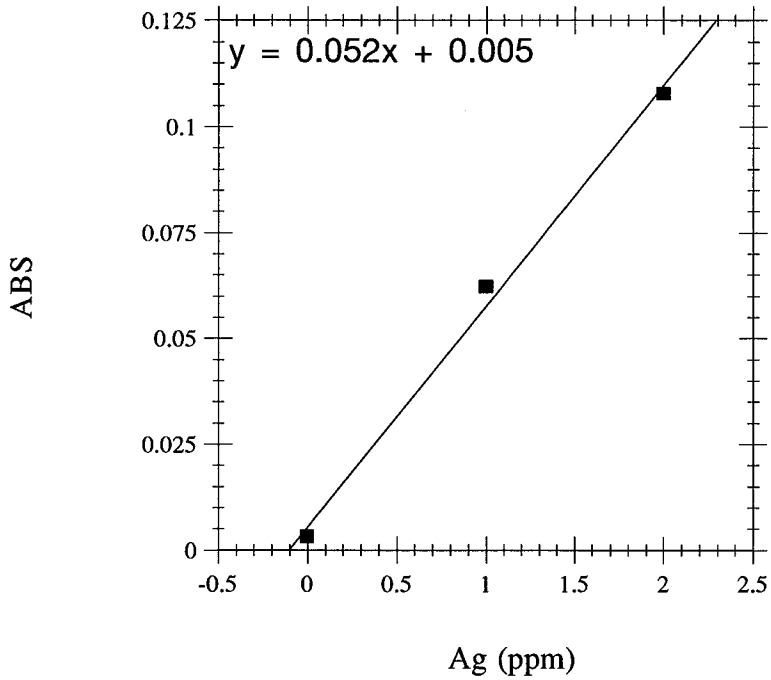
SAN-023 NaOAc



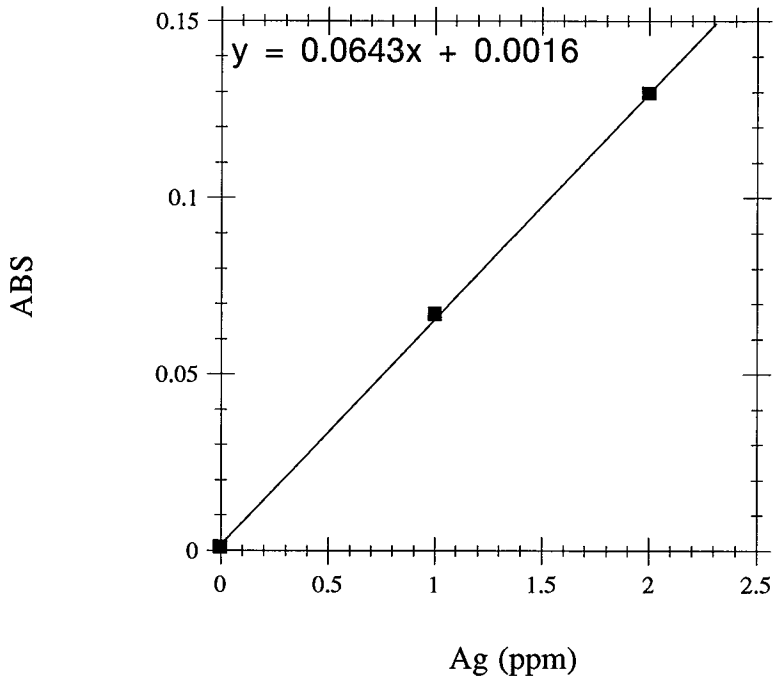
.0542 x 2 = .1084

$.1084 \times \frac{8}{1.022} = .848$ ppm

SAN-023 NaOAc



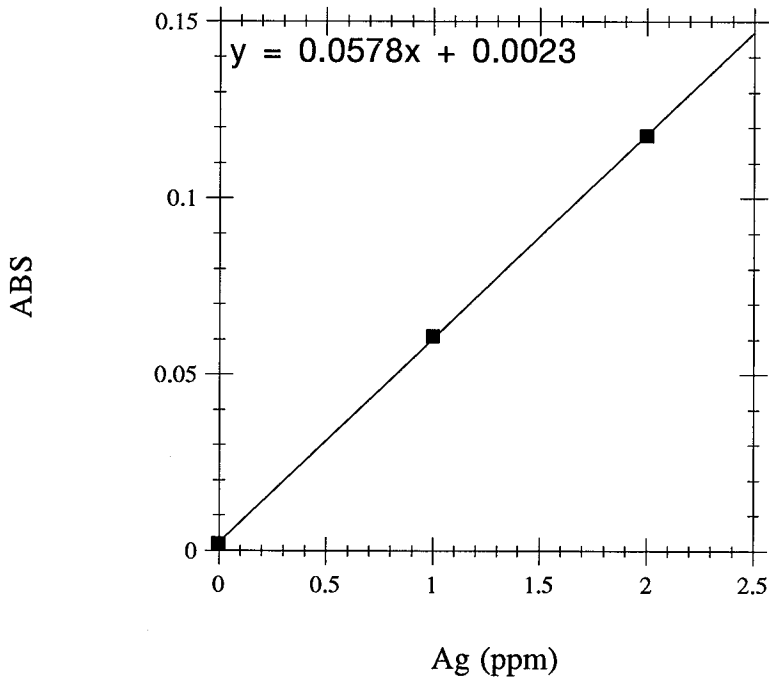
SAN-024 NaOAc



.0249 x 2 = .0498

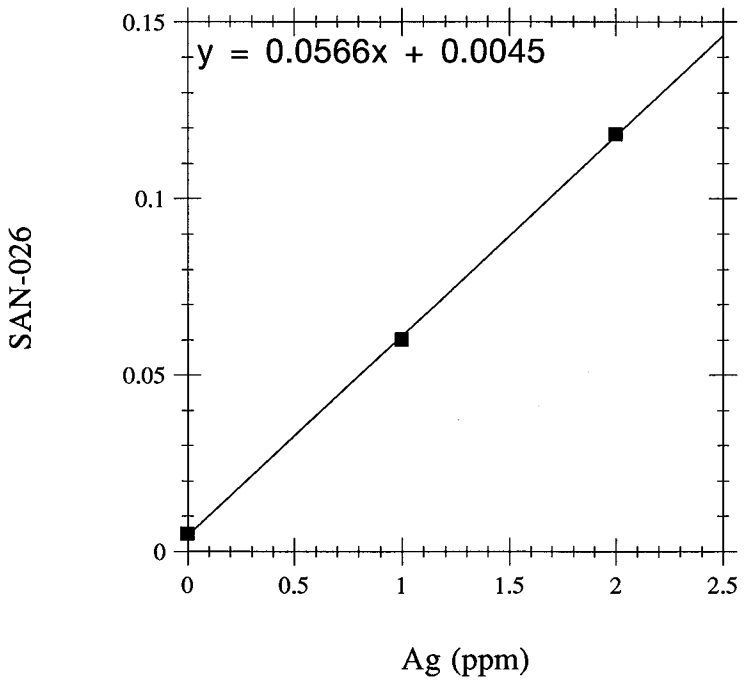
.0498 x 8 / 1.018 = .391 ppM

SAN-025 NaOAc



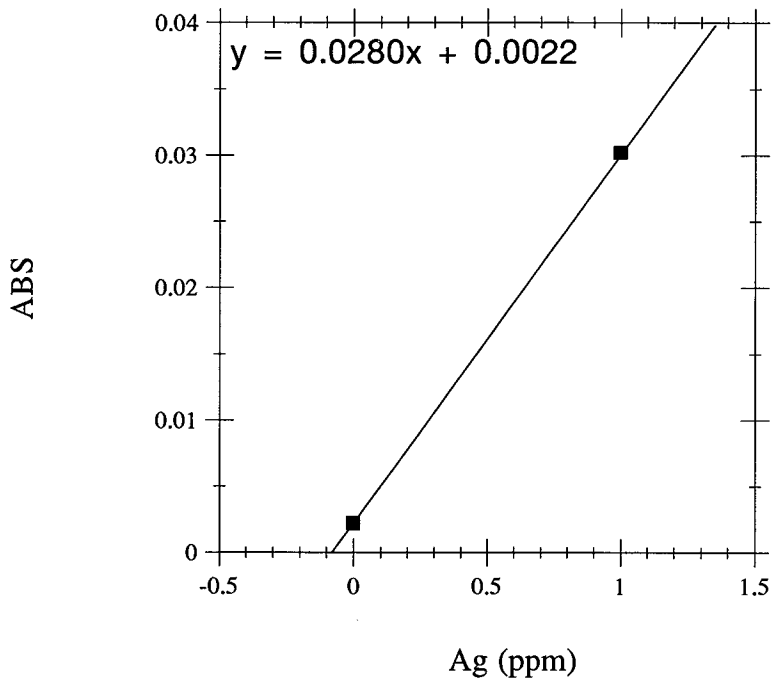
$.0398 \times 2 = .0796 \times \frac{8}{1.025} = .621$ ppm

SAN-026 NaOAc



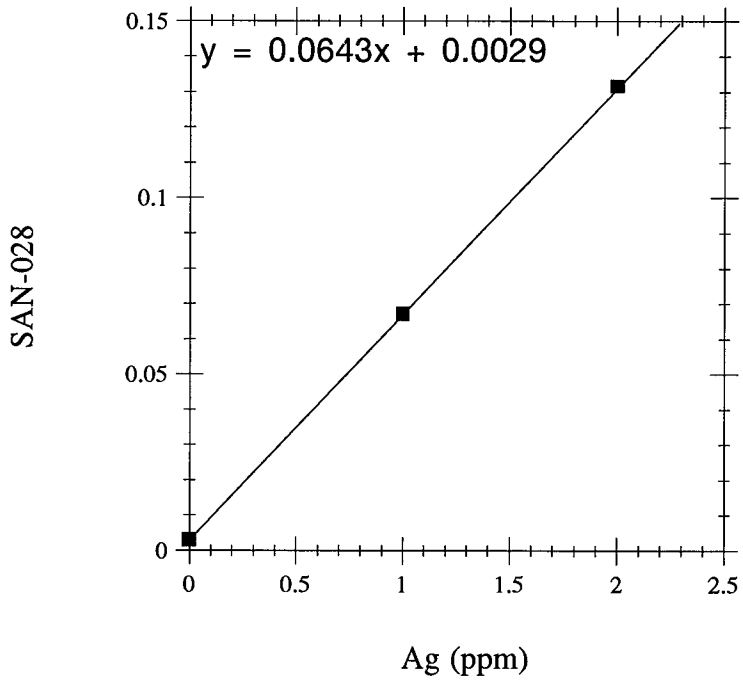
$.0795 \times 2 = .159 \times \frac{8}{1.021} = 1.246$ ppm

SAN-027 NaOAc



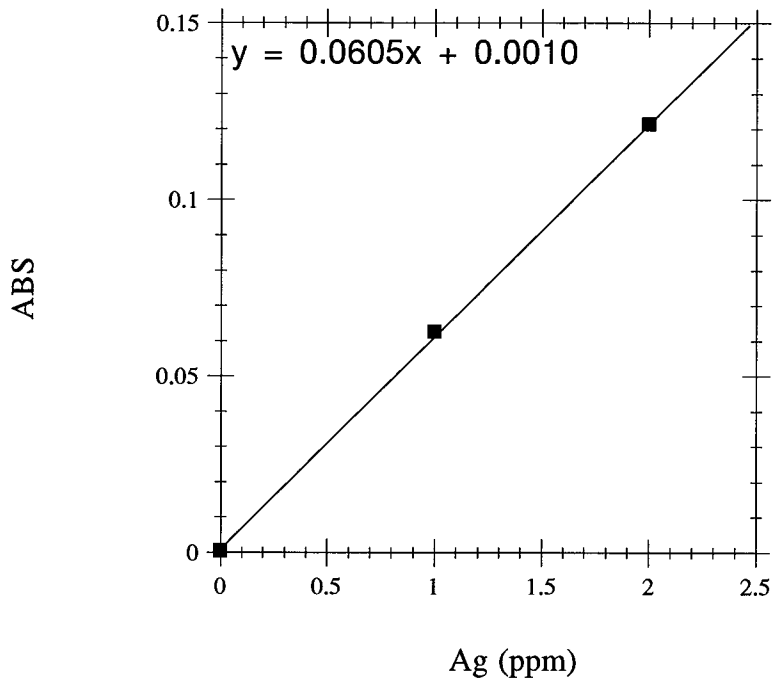
$.0786 \times 2 = .1572 \times \frac{8}{1.013} = 1.24$ ppm

SAN-028 NaOAc



.0451 x 2 = .0902 + 8 / 1.023 = .705 ppm

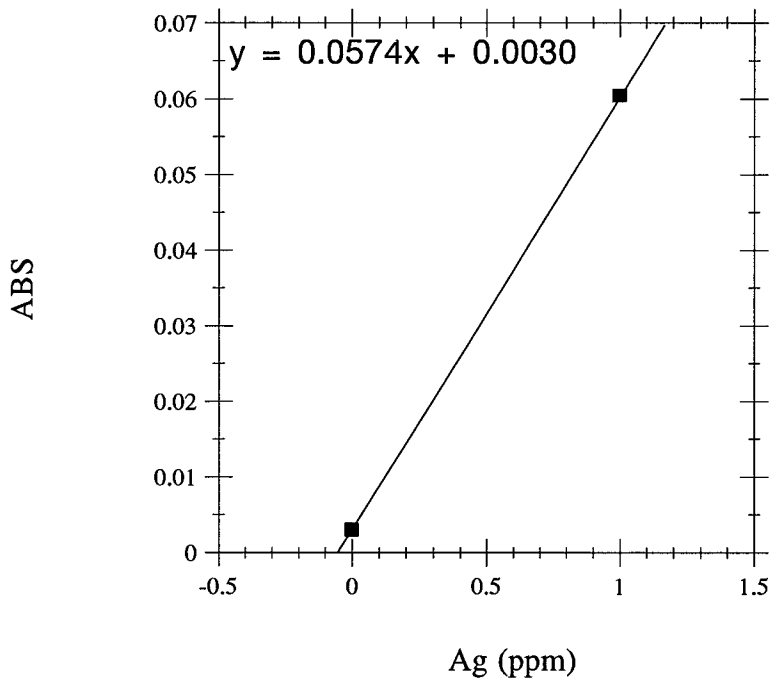
SAN-029 NaOAc



.0165 x 2 = .033

.033 x 8/1.020 = ~~.258~~ .259 ppm

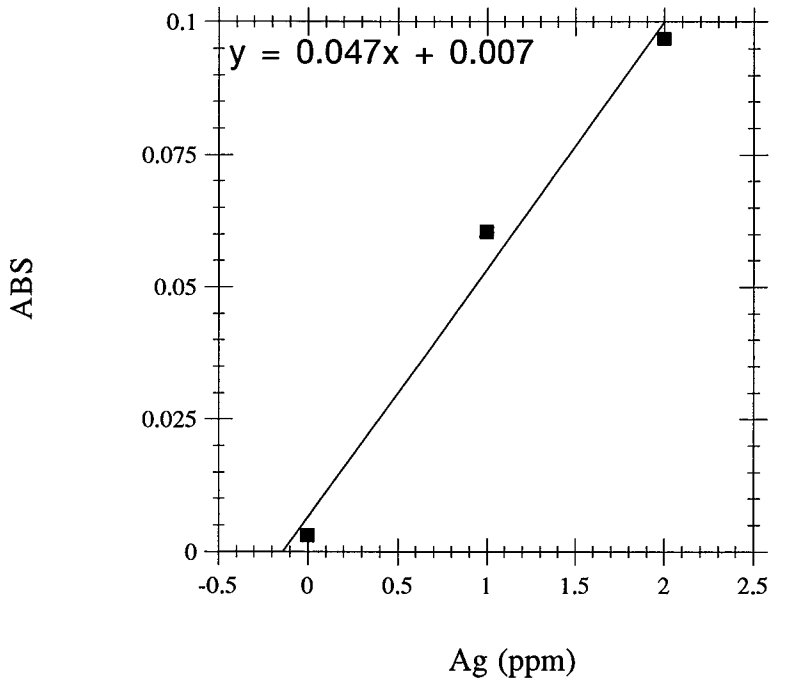
SAN-030 NaOAc



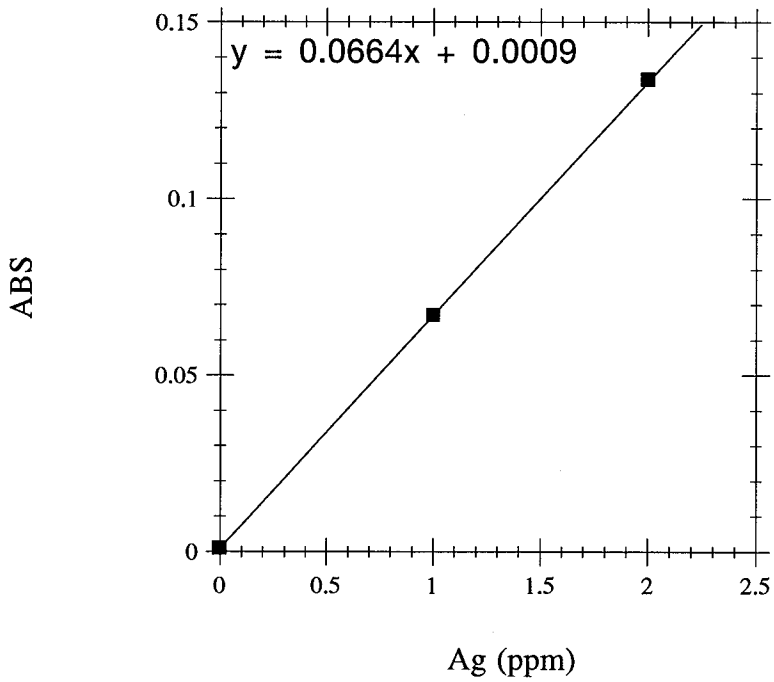
.0523 x 2 = .1046

$.1046 \times \frac{8}{1.022} = .819$ ppm

SAN-030 NaOAc



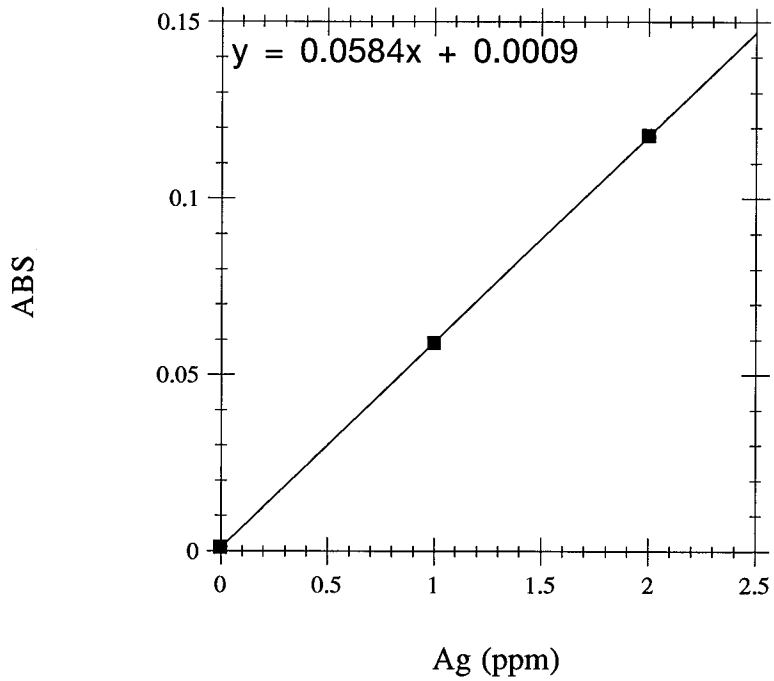
SAN-031 NaOAc



.0135 x 2 = .0270

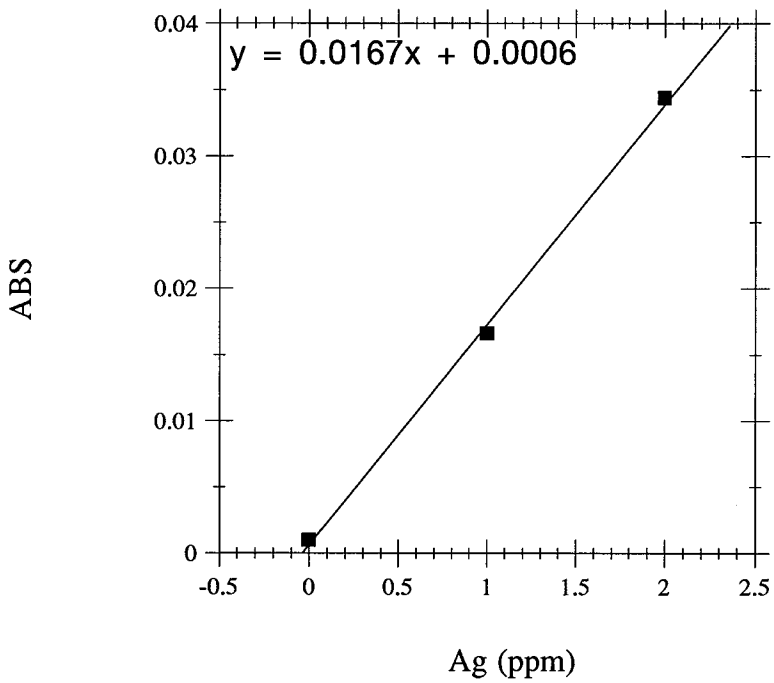
.027 + 8 / 1.026 = .210 ppm

SAN-032 NaOAc



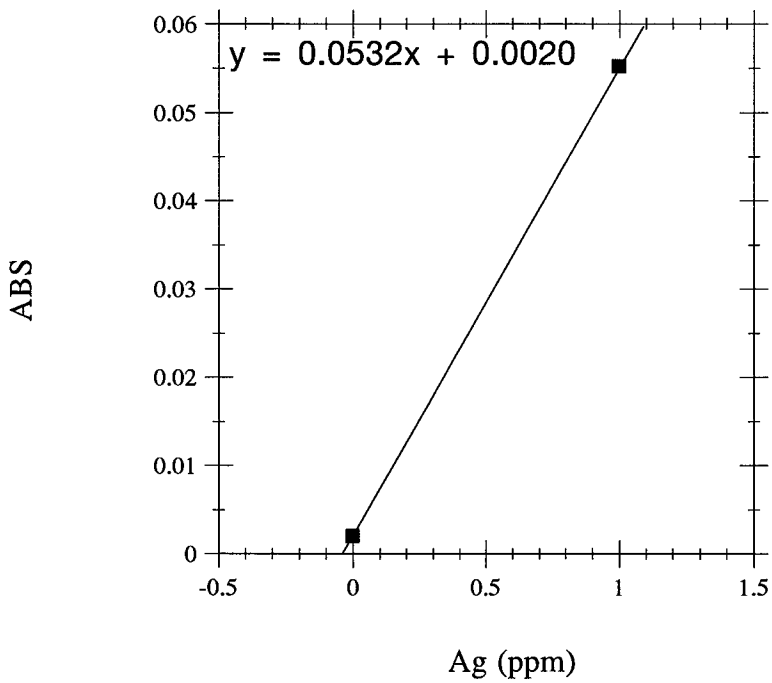
$.0154 \times 2 = .0308 \times \frac{8}{1.017} = .242$ ppm

SAN-033 NaOAc



.0359 x 2 = .0718 x 8/1.012 = .567 ppm

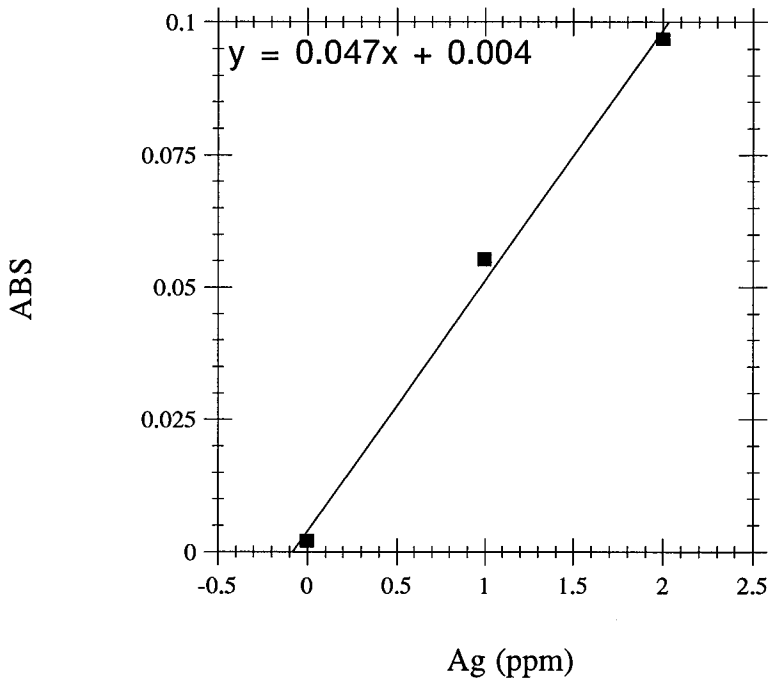
SAN-034 NaOAc



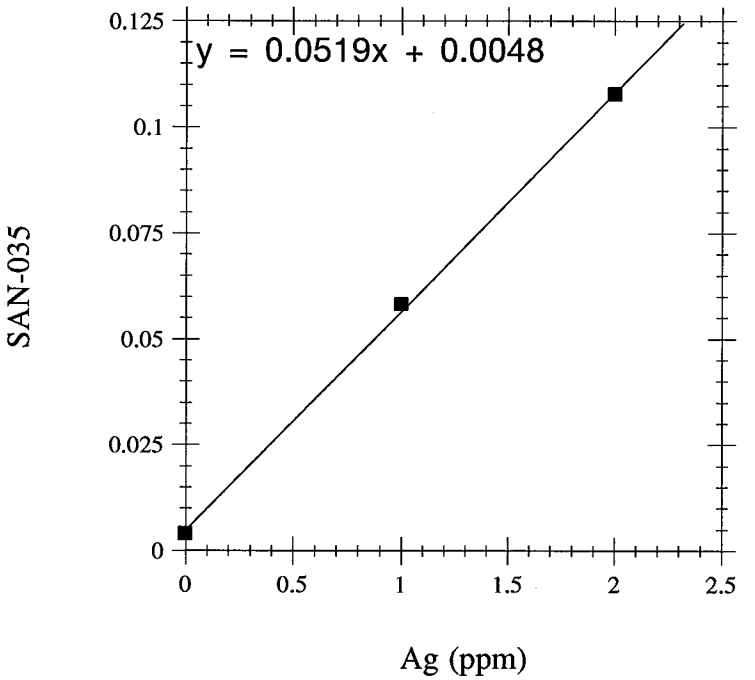
.0376 x 2 = .0752

.0752 x 8/1.009 = .596 ppm

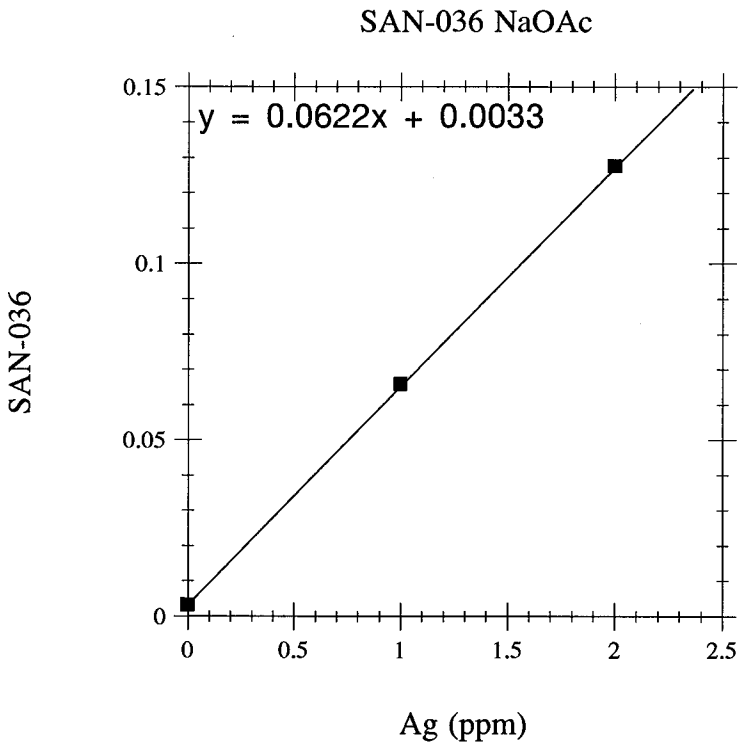
SAN-034 NaOAc



SAN-035 NaOAc

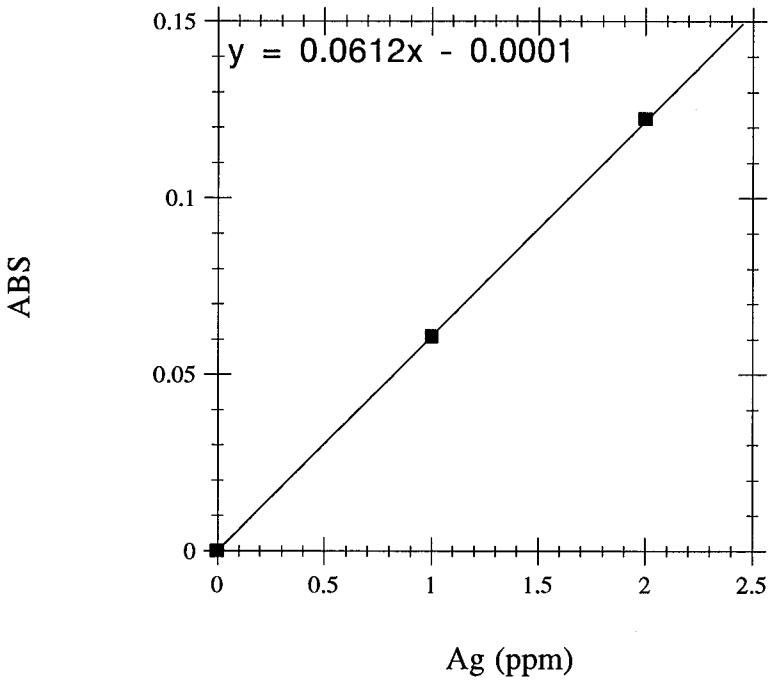


$.09252 = .1904 \times \frac{8}{1.02} = 1.493\ ppm$

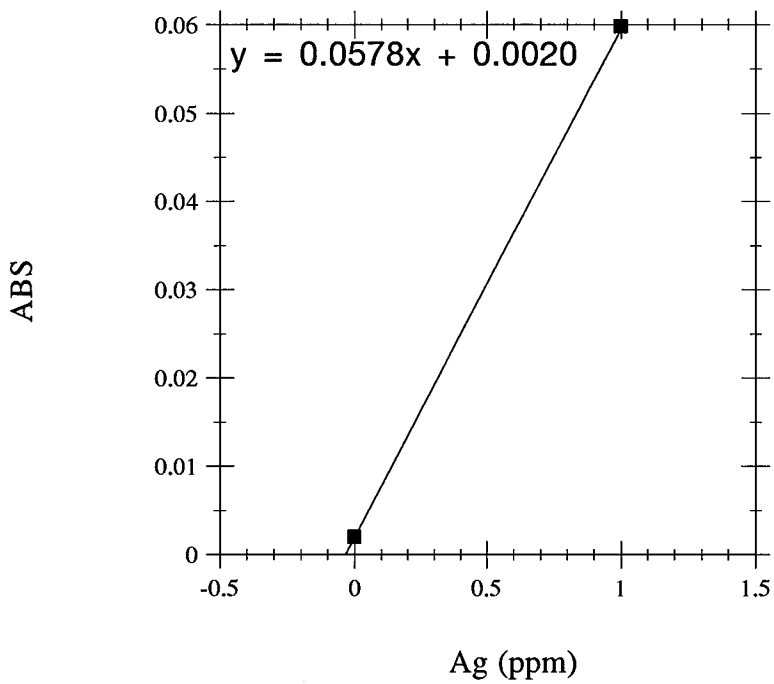


.0530 x 2 = .106 x 8 / .014 = .836 ppm

SAN-037 NaOAc



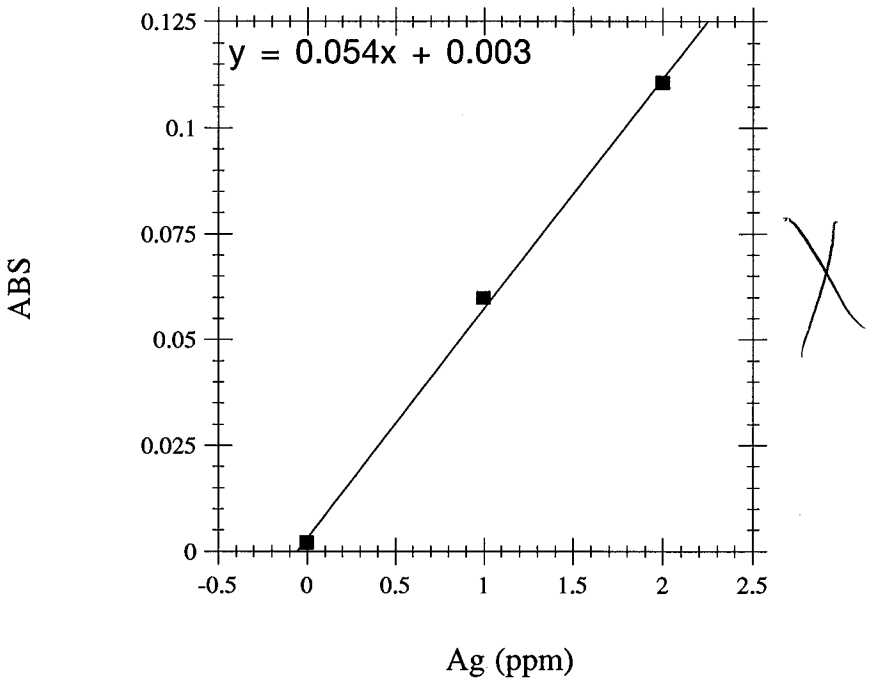
SAN-038 NaOAc



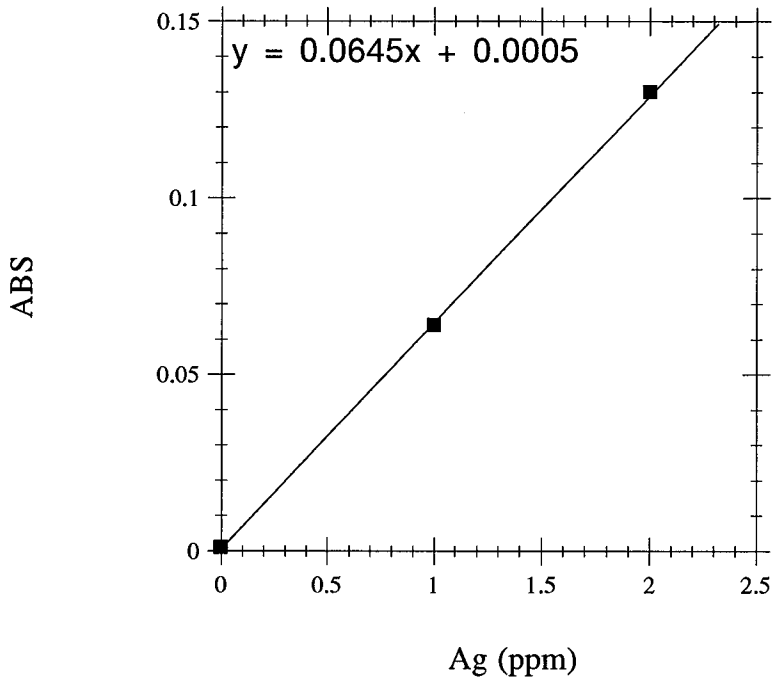
.0346 x 2 = .0692

$\frac{.0692 \times 8}{1.024} = .541$ ppm

SAN-038 NaOAc



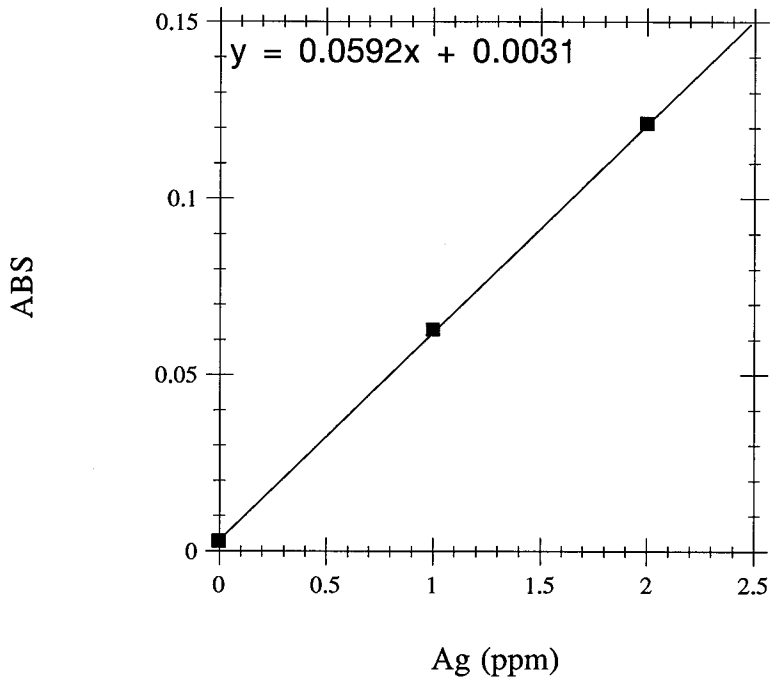
SAN-039 NaOAc



.0077 x 2 = .0154

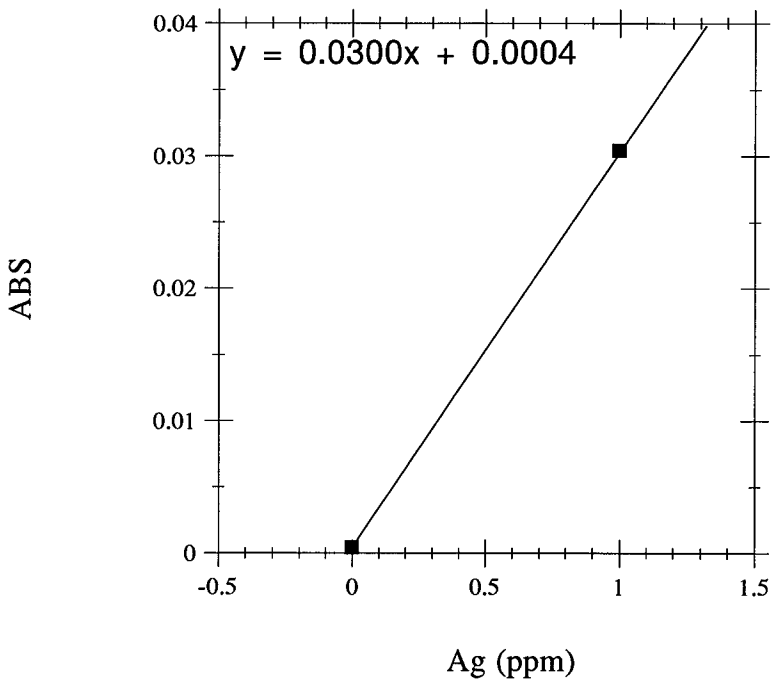
$\frac{.0154 \times 8}{1.018} = .121$ ppm

SAN-040 NaOAc



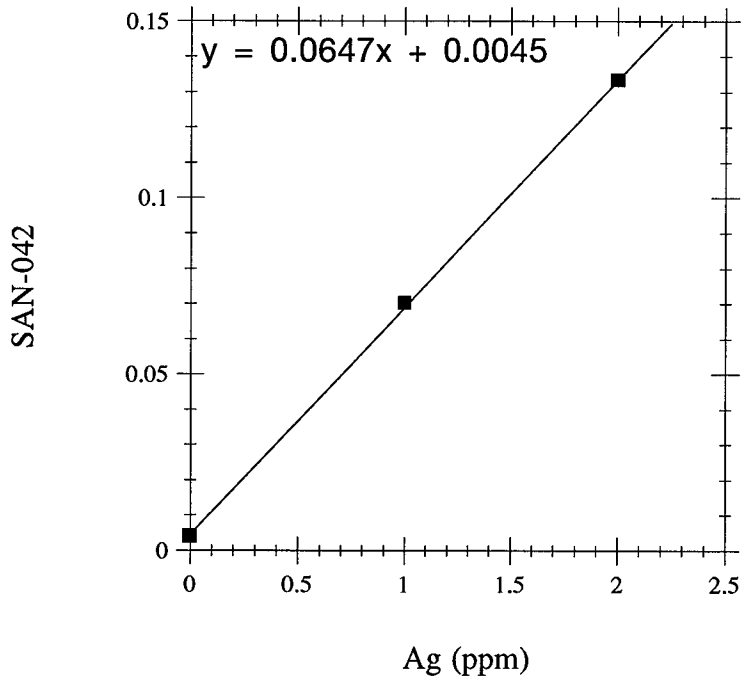
$.0524 \times 2 = .1048 \times \frac{8}{1.017} = .824$ ppm

SAN-041 NaOAc



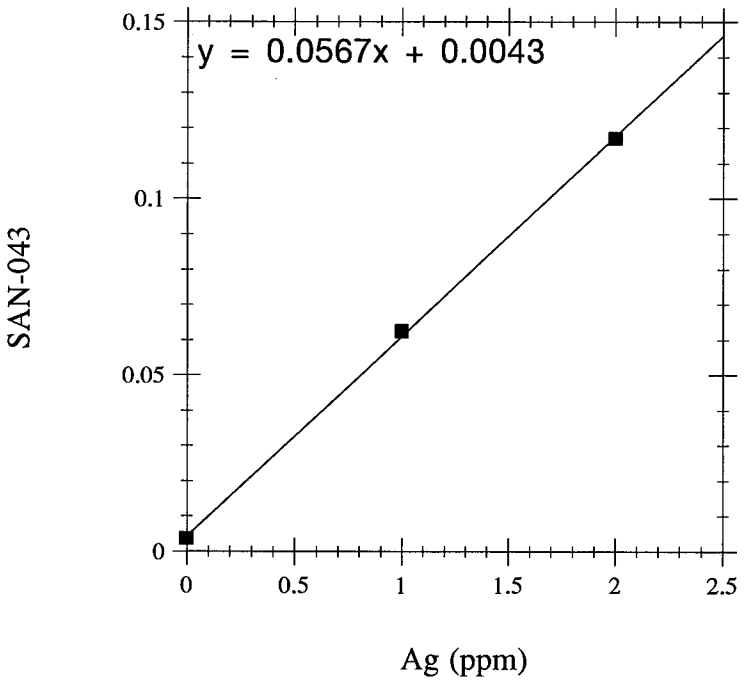
.0133 x 2 = .0266 x 8/1.015 = .209 ppm

SAN-042 NaOAc



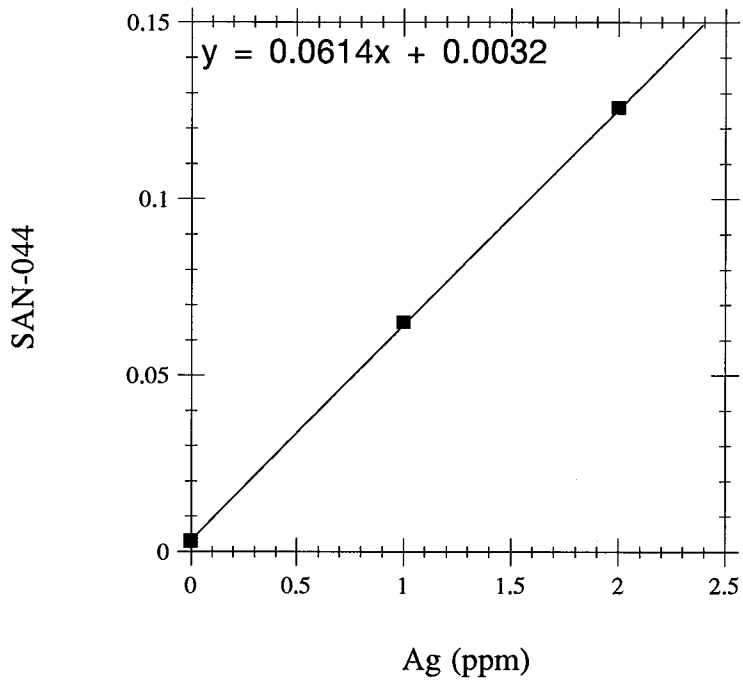
$.0695 \times 2 = .139 \times \frac{8}{1.012} = 1.098$ ppm

SAN-043 NaOAc



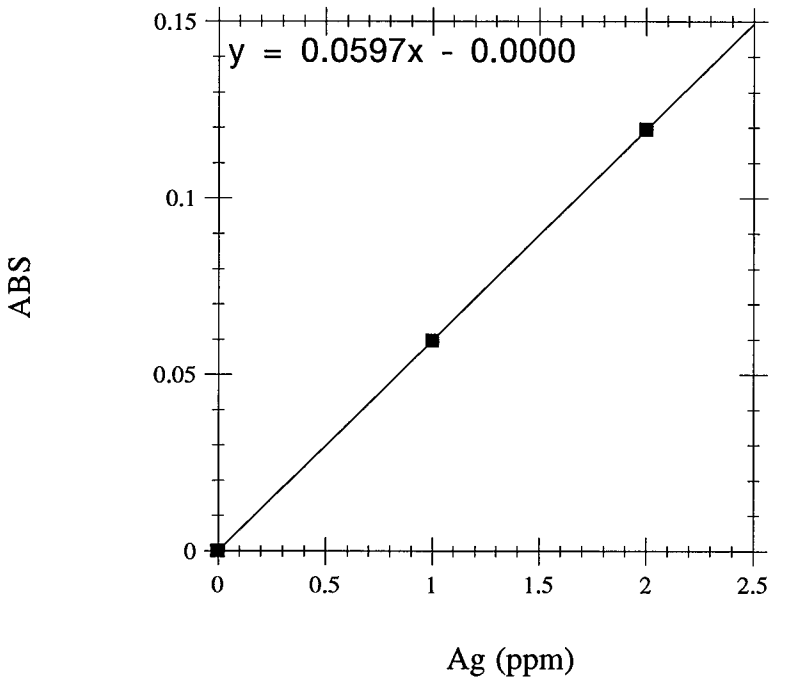
$.0758 \times 2 = .1516 \times \frac{8}{1.022} = 1.187\ ppm$

SAN-044 NaOAc

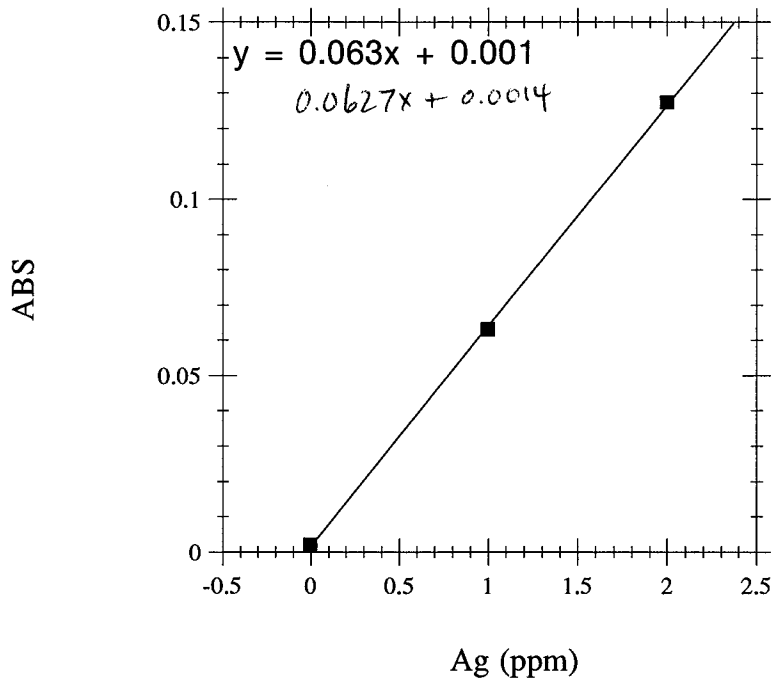


$.0521 \times 2 = .1042 + \frac{8}{1.014} = .822 ppm$

SAN-045 NaOAc



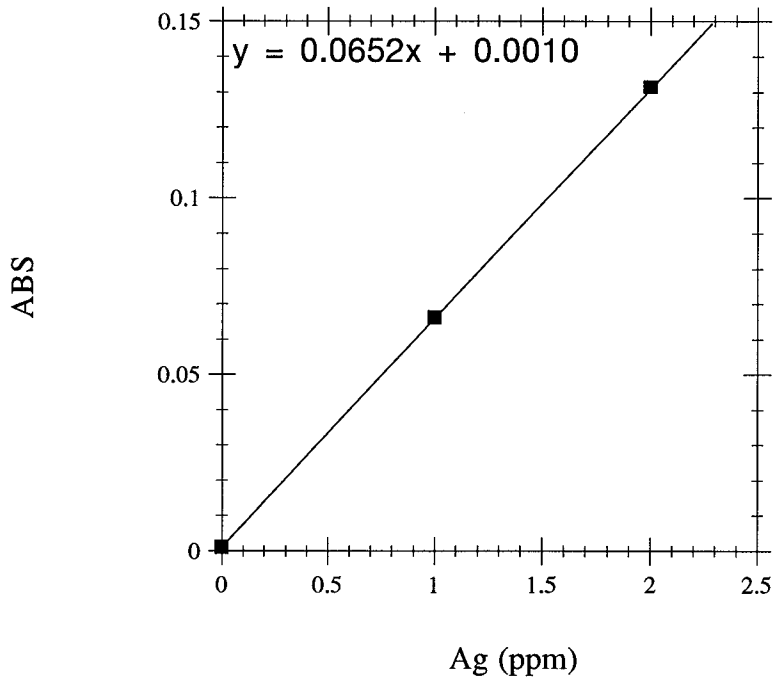
SAN-046 NaOAc



.0223 x 2 = .0446

$.0446 \times \frac{8}{1.022} = .349$ ppm

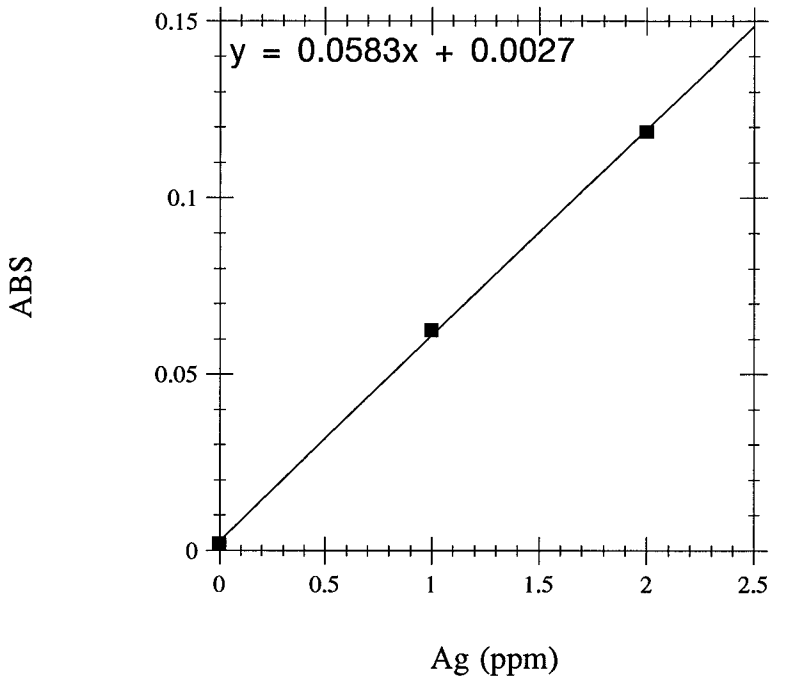
SAN-047 NaOAc



.0153 x 2 = .0306

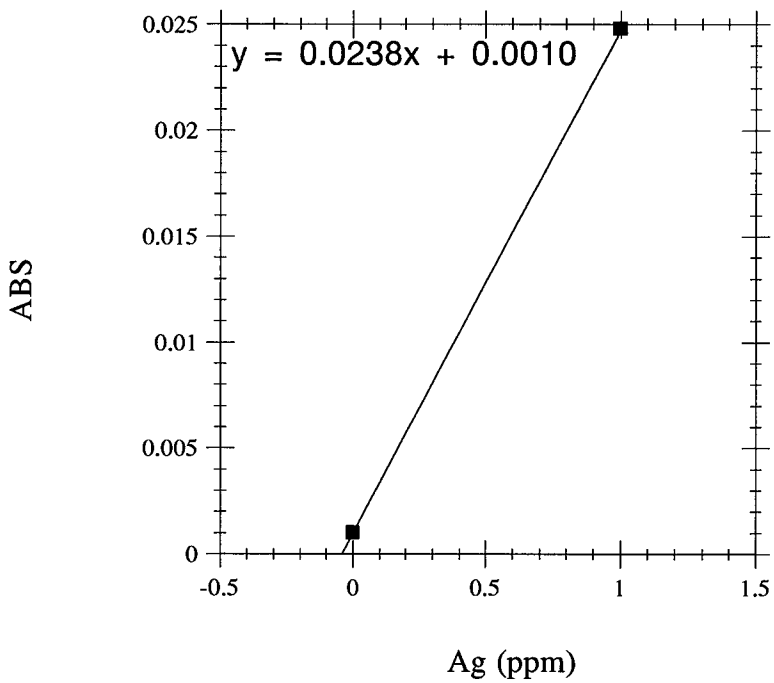
.0306 x 8 / 1.023 = .239 ppm

SAN-048 NaOAc



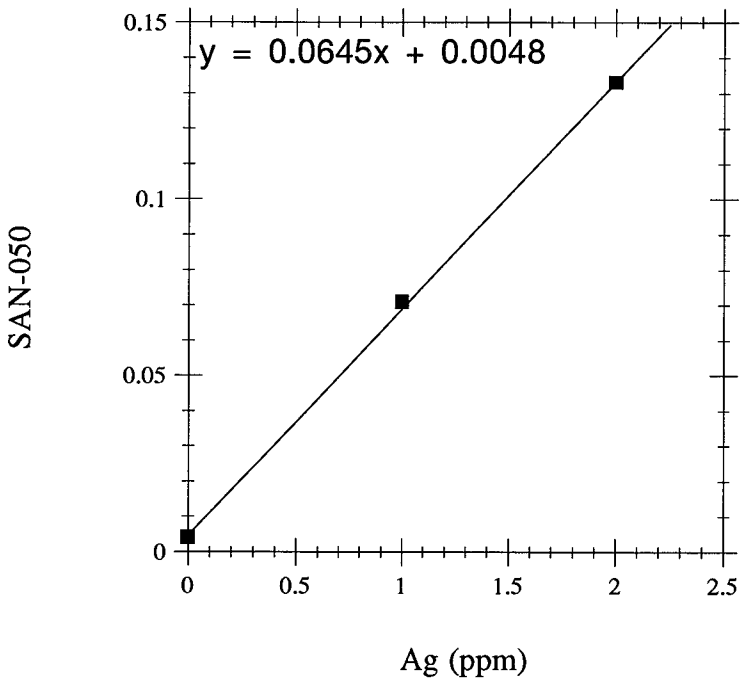
$.0463 \times 2 = .0926 \times \frac{8}{1.022} = .725$ ppm

SAN-049 NaOAc



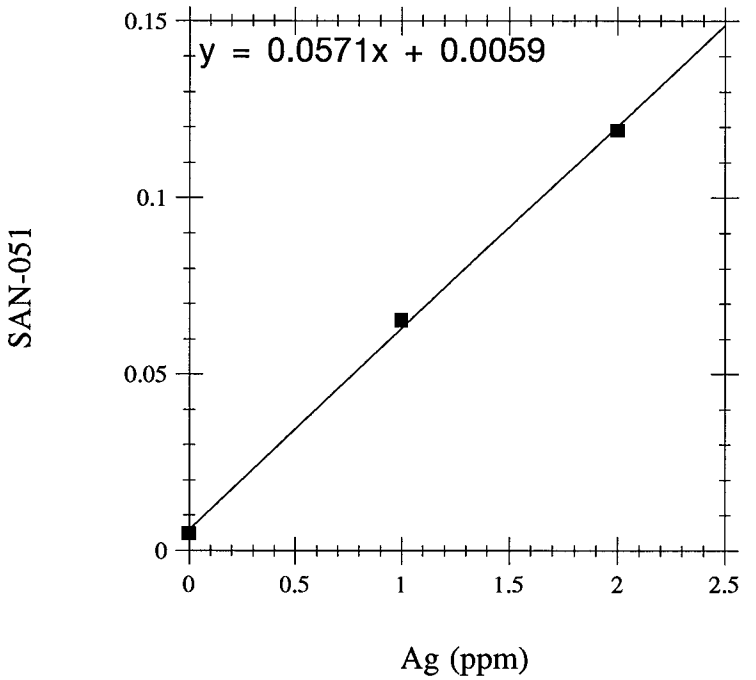
$.0420 \times 2 = .084 \times \frac{8}{1.017} = .661$ ppm

SAN-050 NaOAc



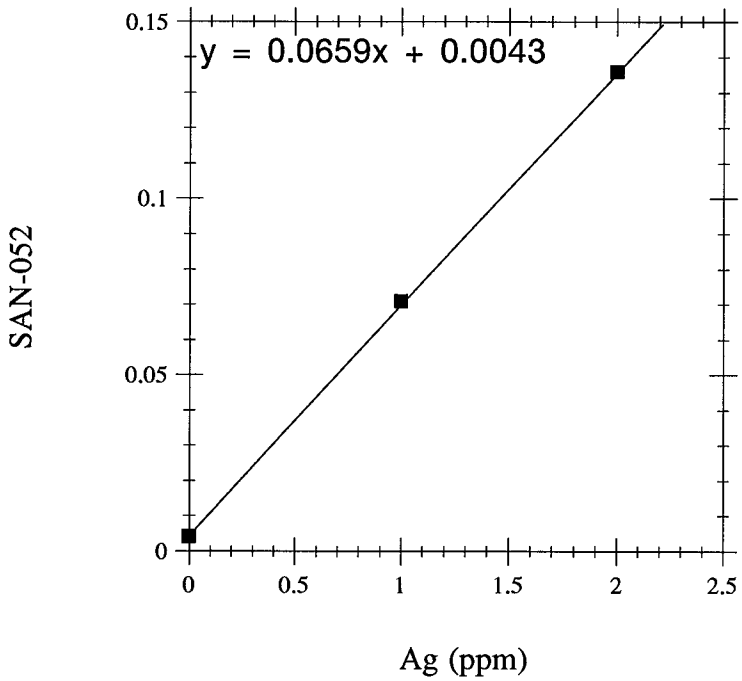
$.0744 \times 2 = .1488 \times \frac{8}{1.016} = 1.172$ ppm

SAN-051 NaOAc



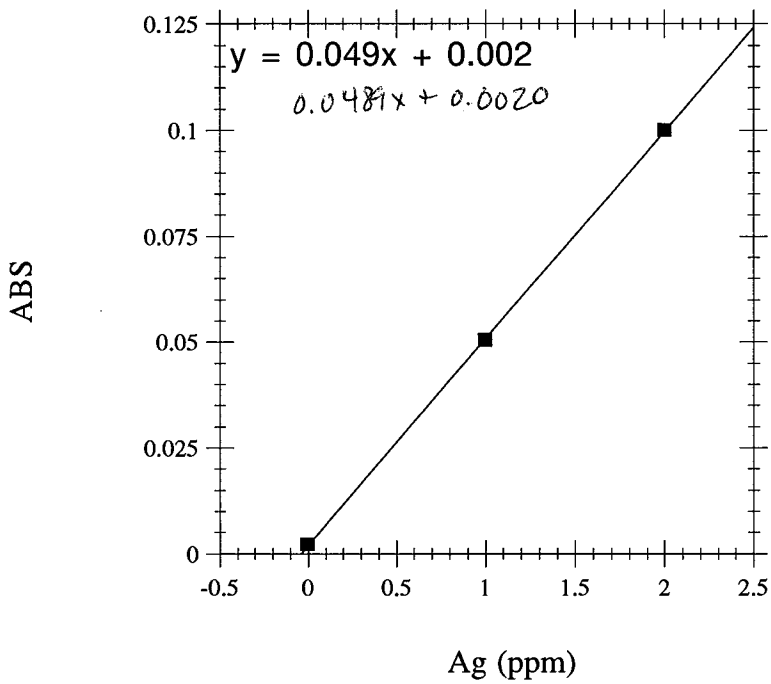
$.1033 \times 2 = .2066 \times \frac{8}{1.017} = 1.625\ ppm$

SAN-052 NaOAc



$.0652 \times 2 = .1304 \times \frac{8}{1.02} = \underline{1.023 \text{ ppm}}$

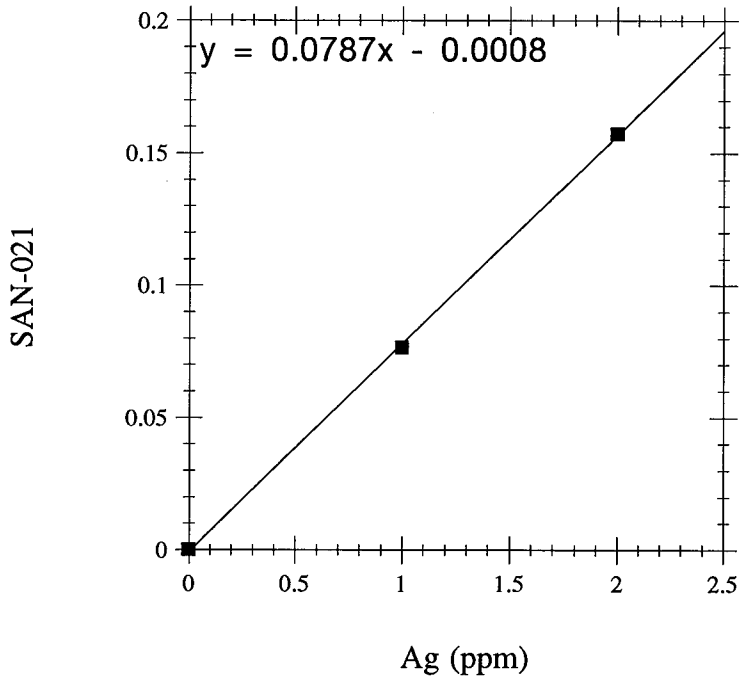
SAN-053 NaOAc



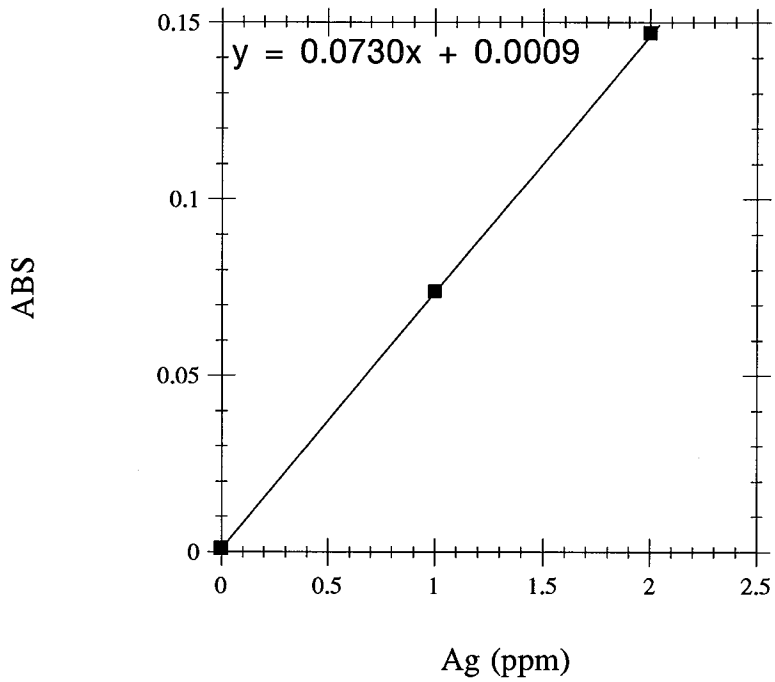
.0409 x 2 = .0818

$\frac{.0818 \times 8}{1.008} = .649$ ppm

SAN-021 NH2OH



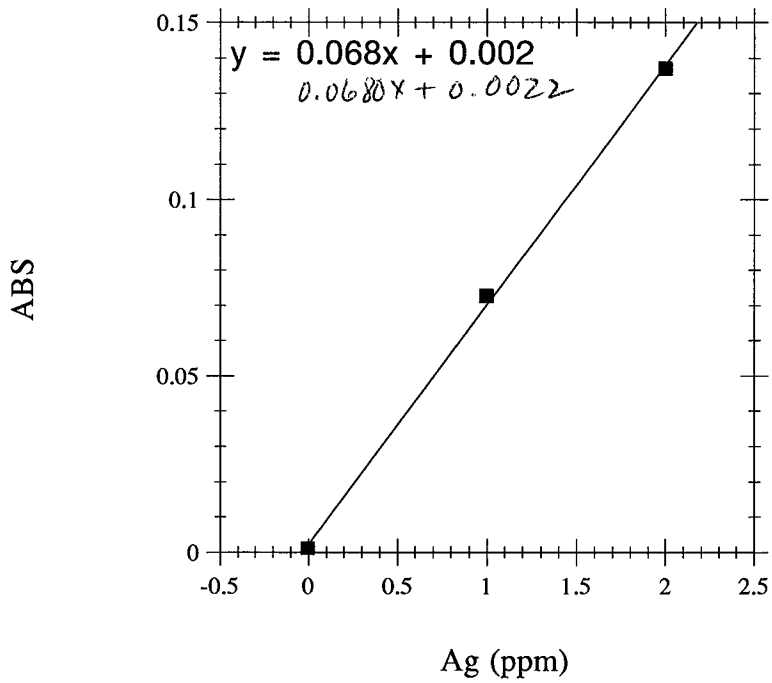
SAN-022 NH2OH



.0123 x 2 = .0246

$\frac{.0246 \times 8}{1.022} = .192$ ppm

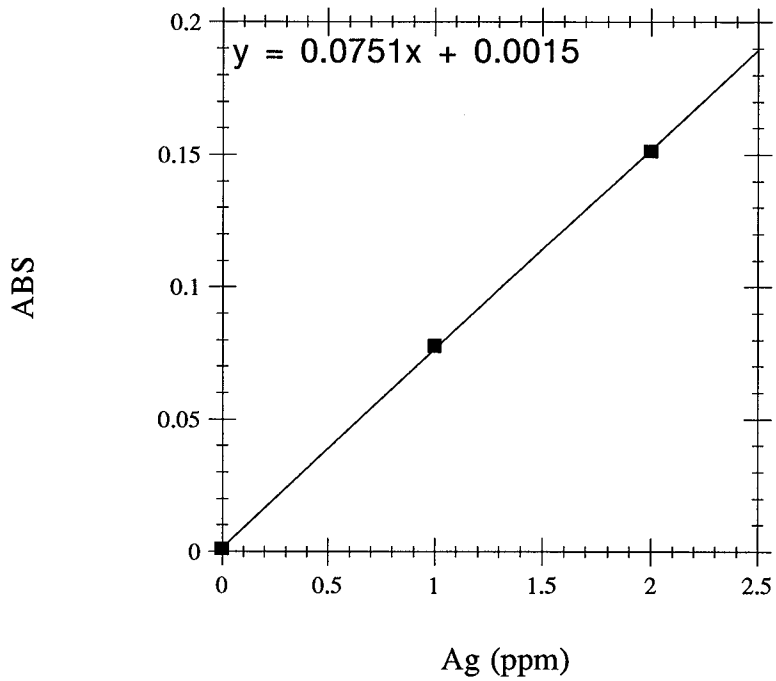
SAN-023 NH2OH



.0323 x2 = .0646

$.0646 \times \frac{8}{1022} = .506$ ppm

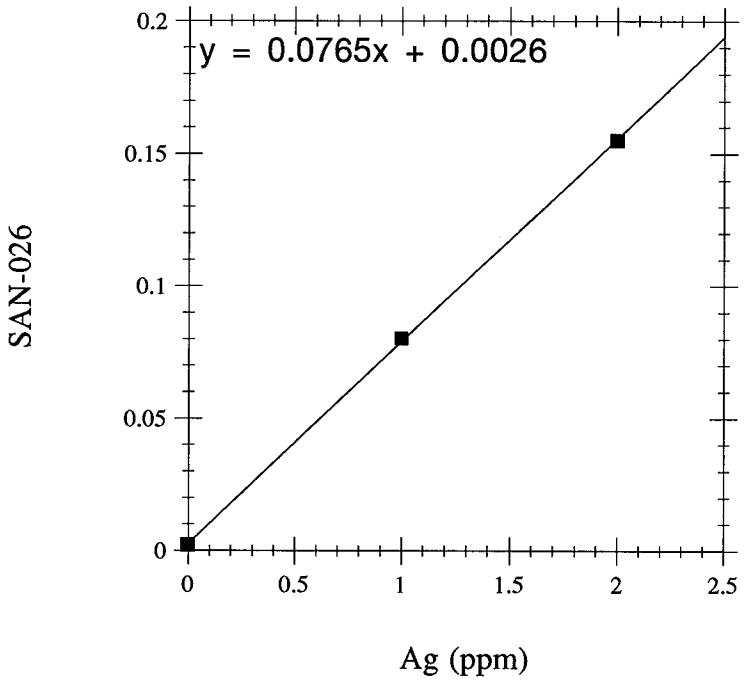
SAN-024 NH2OH



.0199 x 2 = .0398

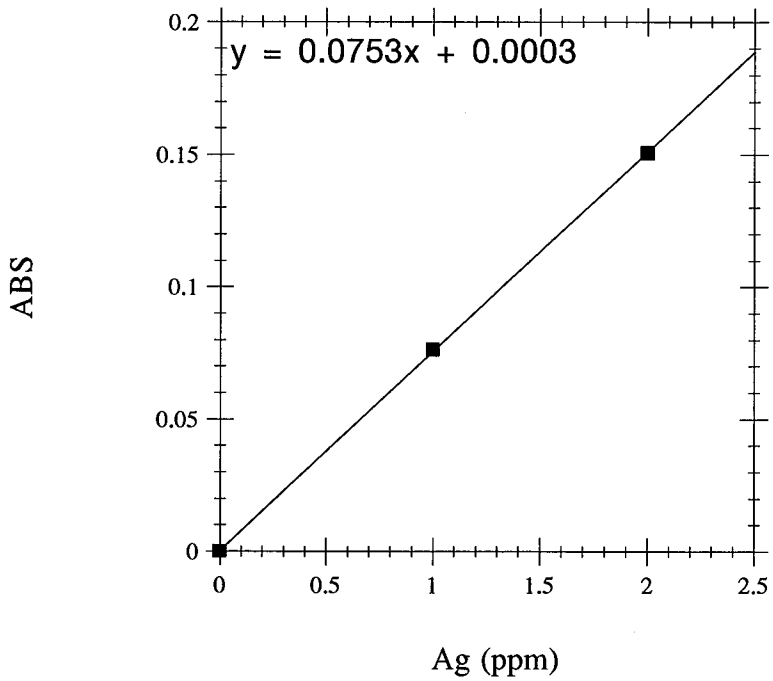
$\frac{.0398 \times 8}{1.018} = .313$ ppm

SAN-026 NH2OH



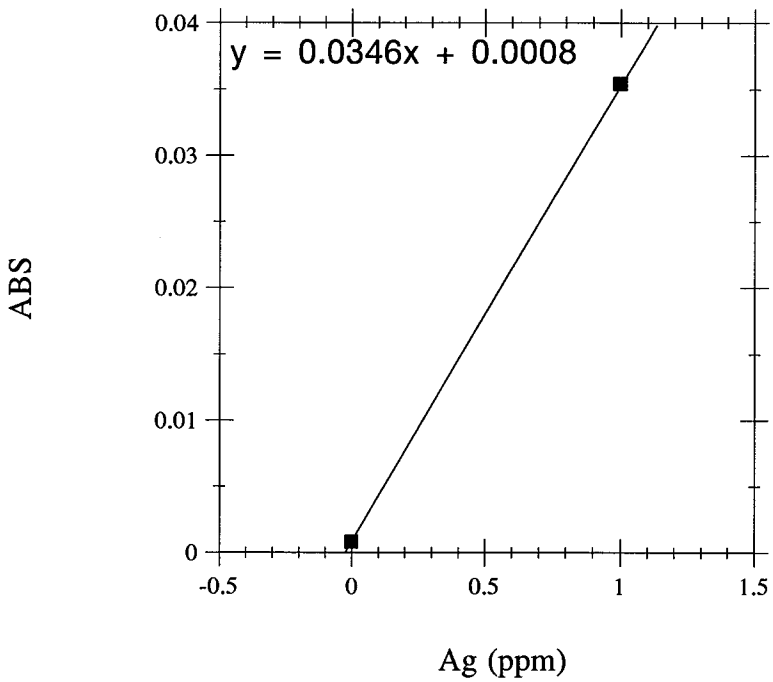
$.034 \times 2 = .068 \times \frac{8}{1.021} = .533 ppm$

SAN-025 NH2OH



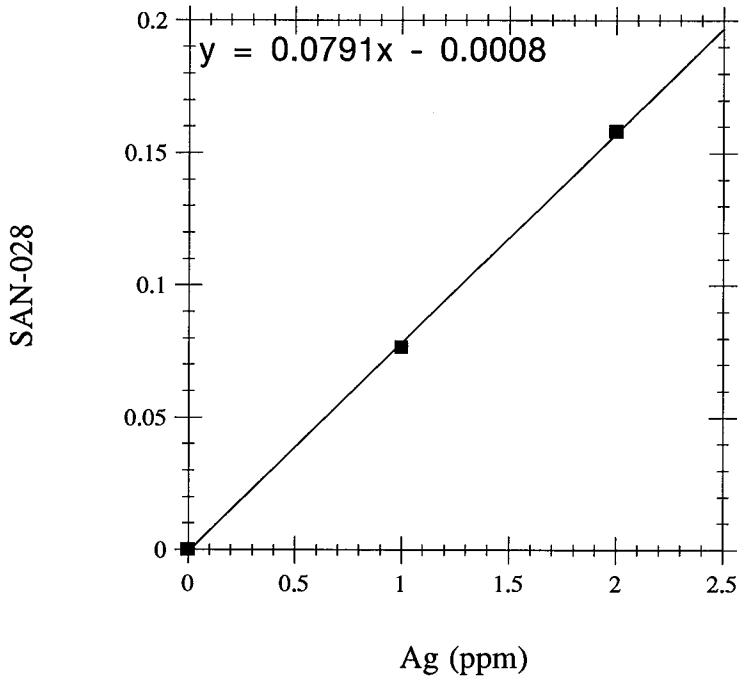
$.604 \times 2 = .008 \times \frac{8}{1.025} = .062$ ppm

SAN-027 NH2OH

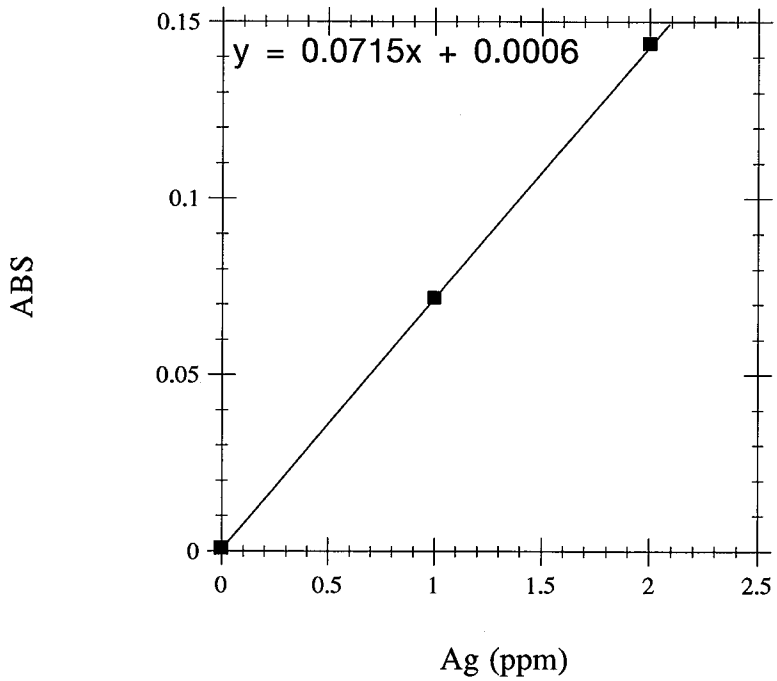


.0231 x 2 = .0462 x 8/1.013 = .365 ppm

SAN-028 NH2OH



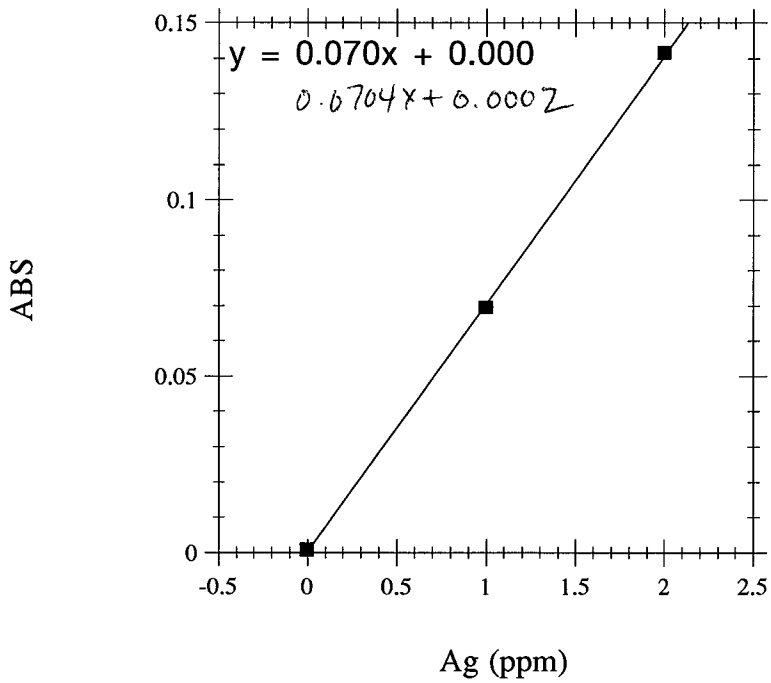
SAN-029 NH2OH



.0084 x 2 = .0168

$\frac{.0168 \times 8}{1.02} = .132$ ppm

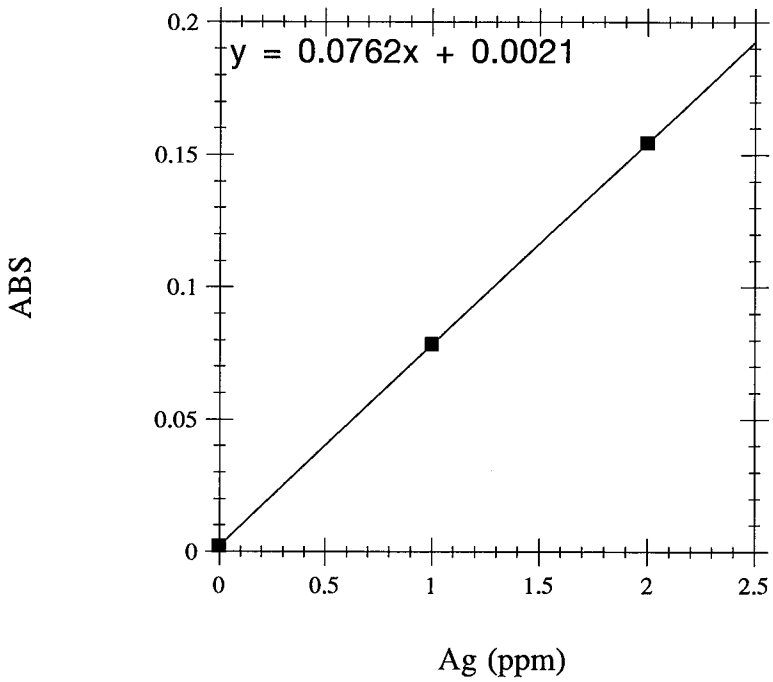
SAN-030 NH2OH



.0028 x2 = .0056

.0056 x 8/1.022 = .044 ppm

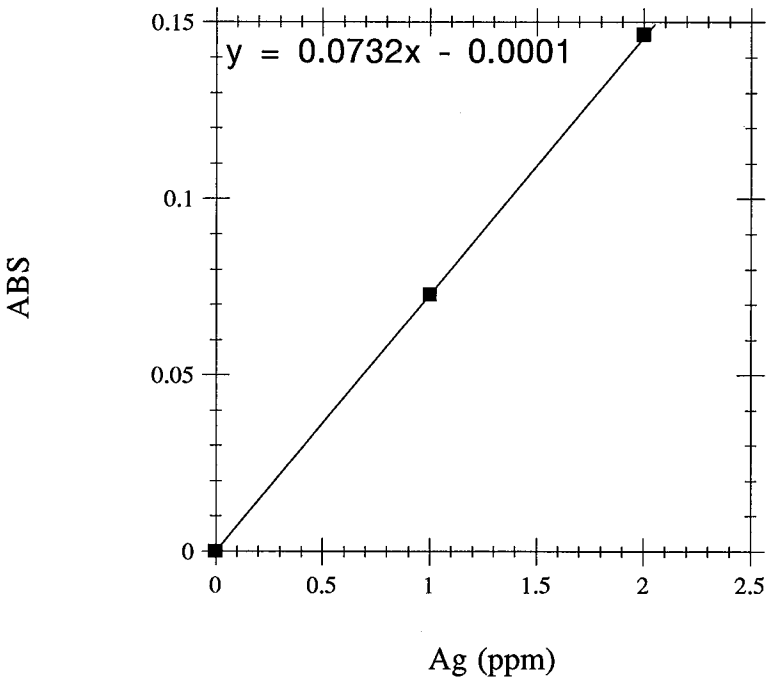
SAN-031 NH2OH



.0276 x 2 = .0552

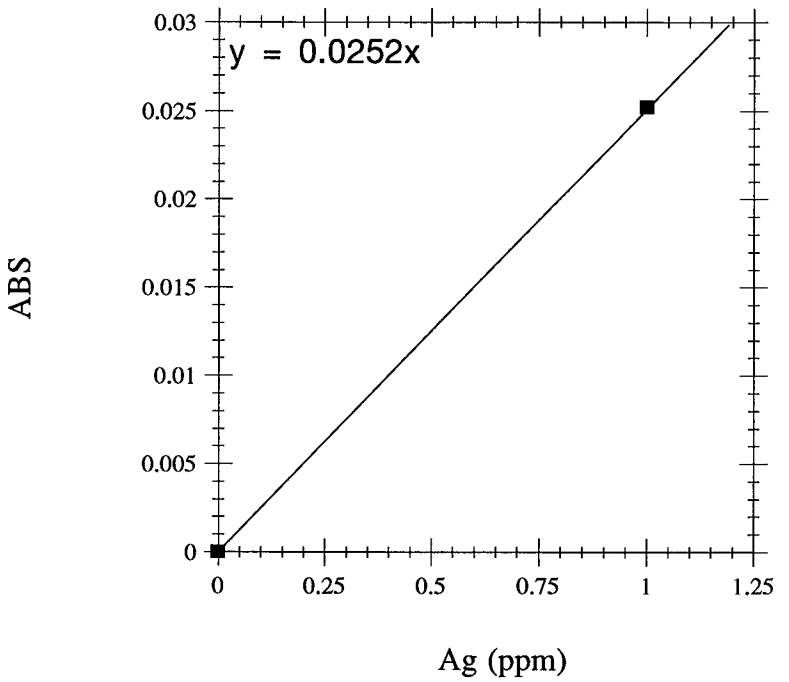
$\frac{.0552 + 8}{1.026} = .43$ ppm

SAN-032 NH2OH



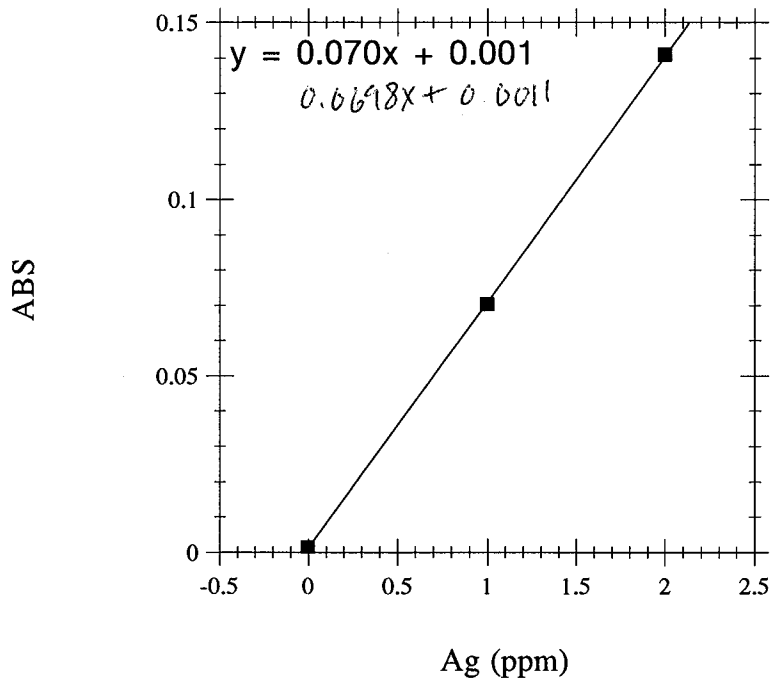
0

SAN-033 NH2OH



0 ppm

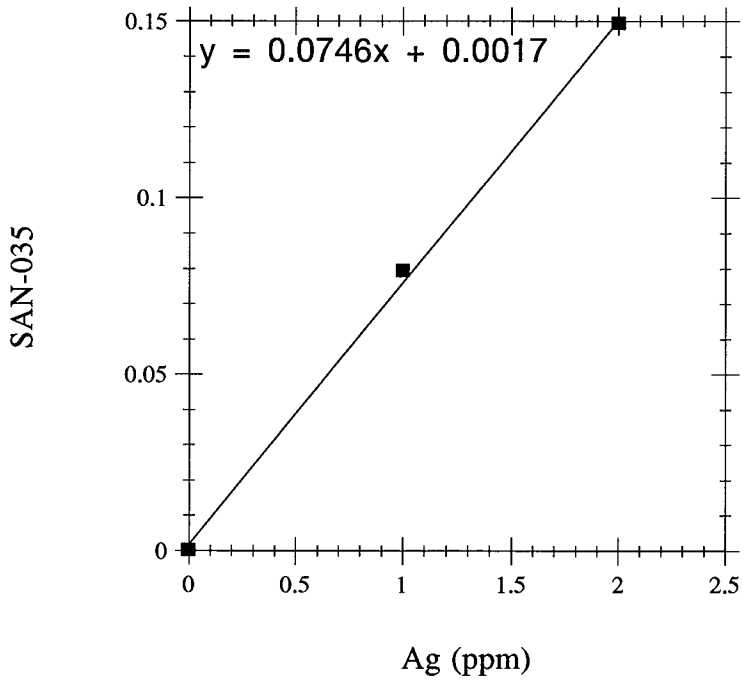
SAN-034 NH2OH



.0157 x 2 = .0314

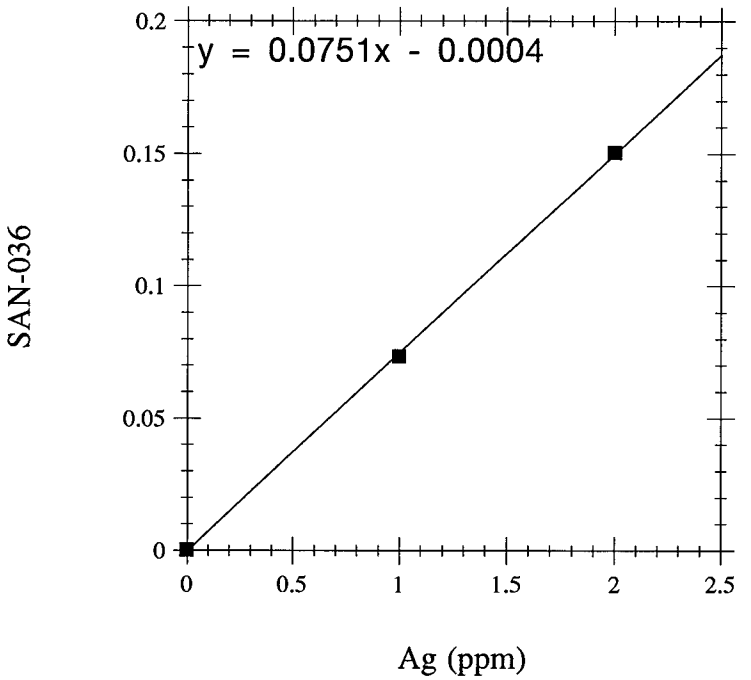
.0314 x 8/1.009 = .249 ppm

SAN-035 NH2OH

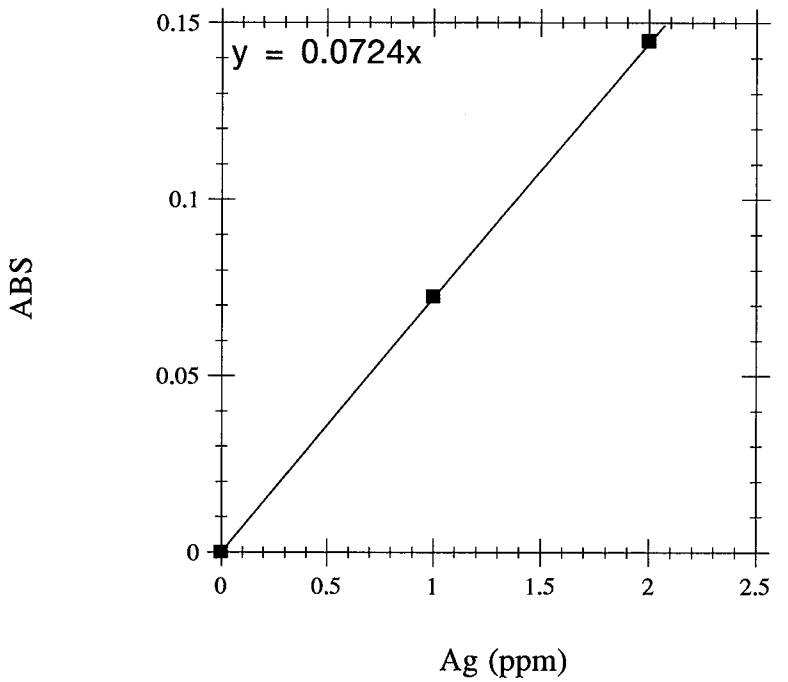


$.0228 \times 2 = .0456 \times \frac{8}{1.02} = .3576$ ppm

SAN-036 NH2OH



SAN-037 NH2OH



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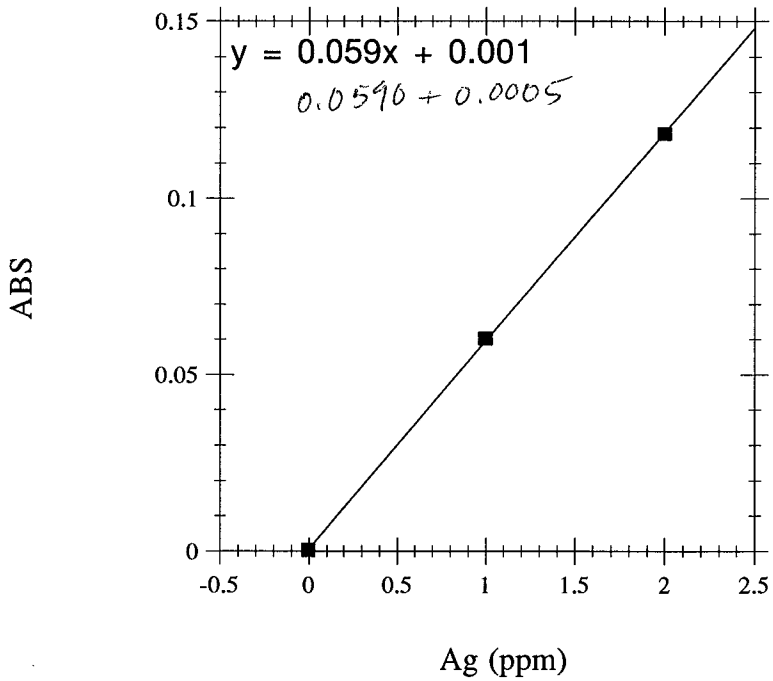
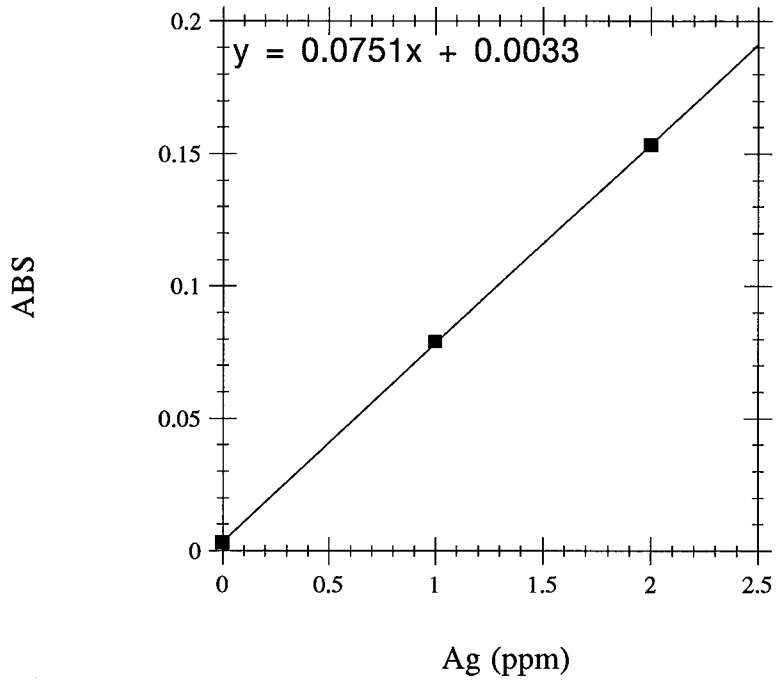
SAN-038 NH2OH



.0085 x 2 = .017

$.017 \times \frac{8}{1.024} = .133$ ppm

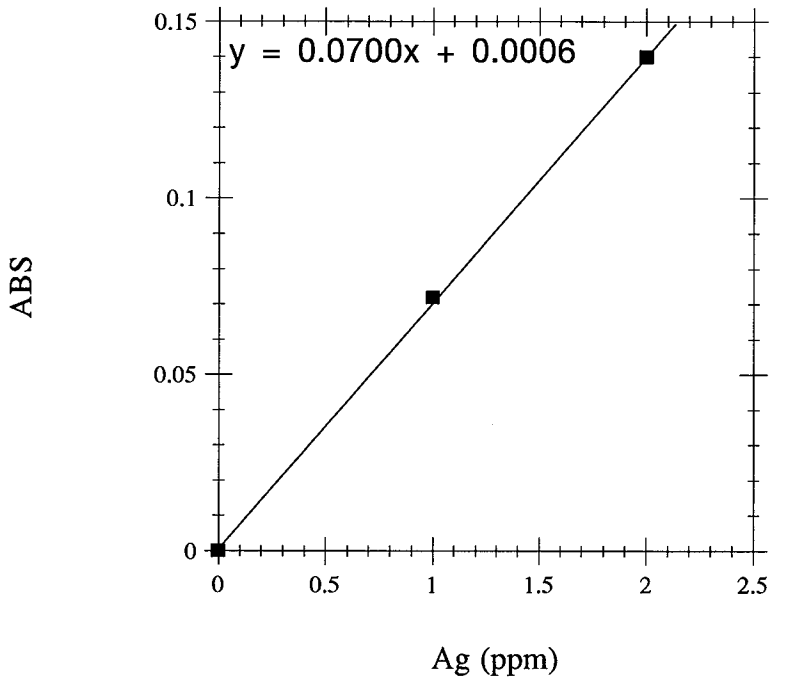
SAN-039 NH2OH



.0439 x 2 = .0878

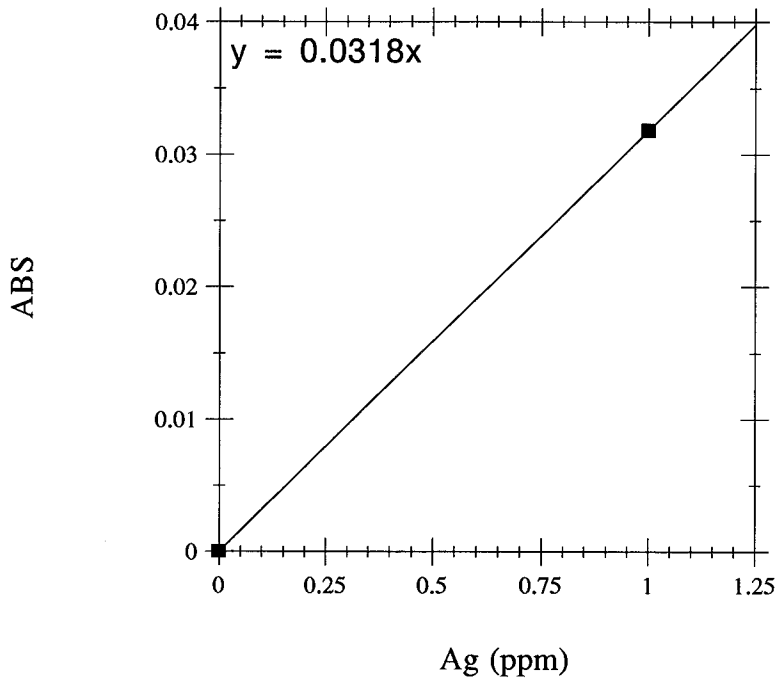
$\frac{.0878 \times 8}{1.018} = .69$ ppm

SAN-040 NH2OH

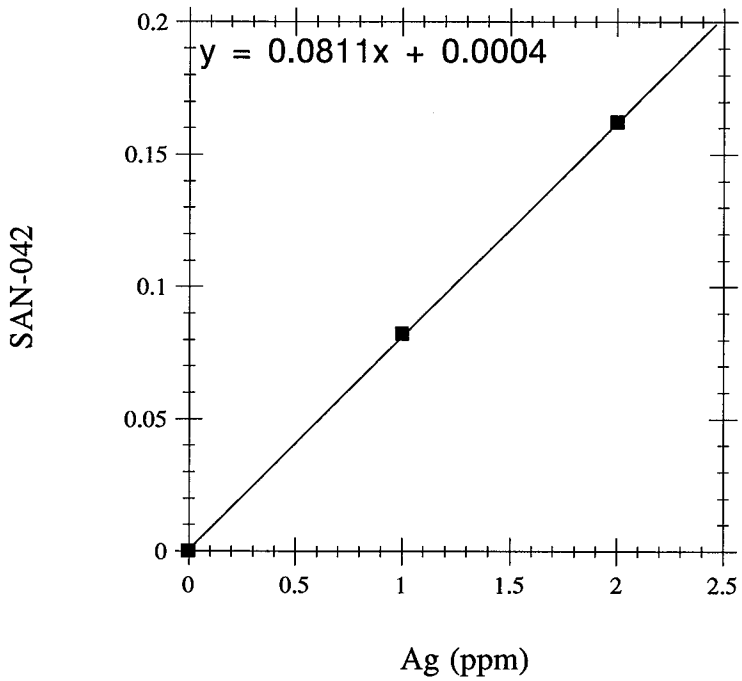


$.0086 \times 2 = .0172 \times \frac{8}{1.017} = .135$ ppm

SAN-041 NH2OH

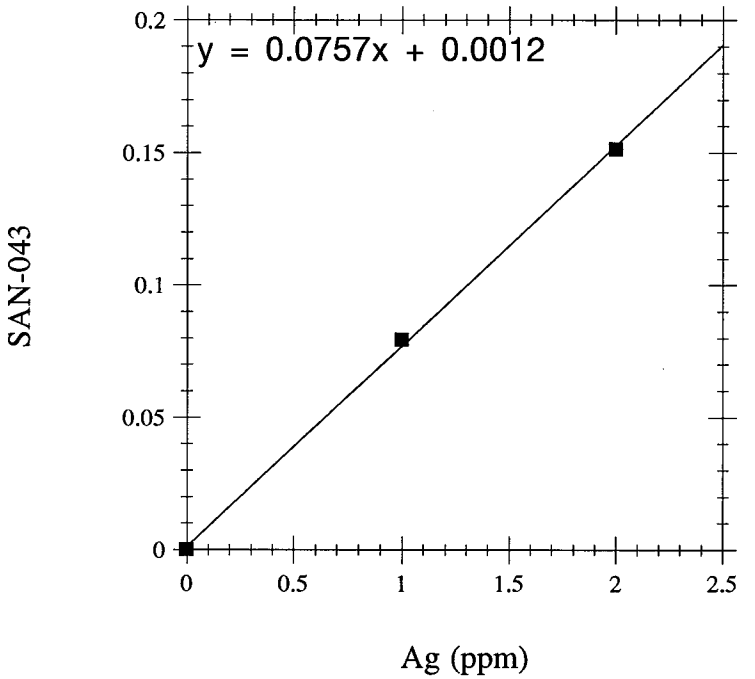


SAN-042 NH2OH



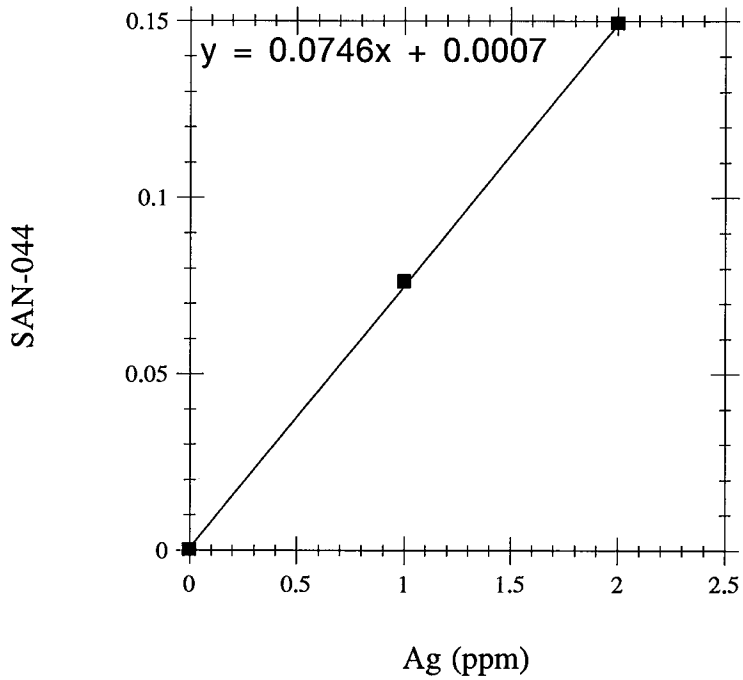
.00492 = .00988 × 8 / 1.012 = .0774 ppm

SAN-043 NH2OH



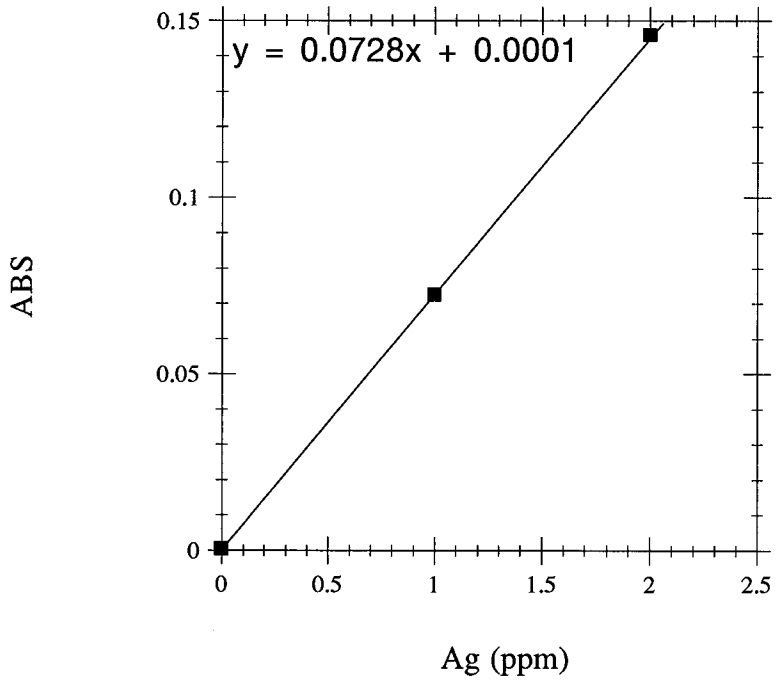
$.0158 \times 2 = .0316 \times \frac{8}{1.022} = .247$ ppm

SAN-044 NH2OH



.0094 x 2 = .0188 x 8/1.014 = .148 ppm

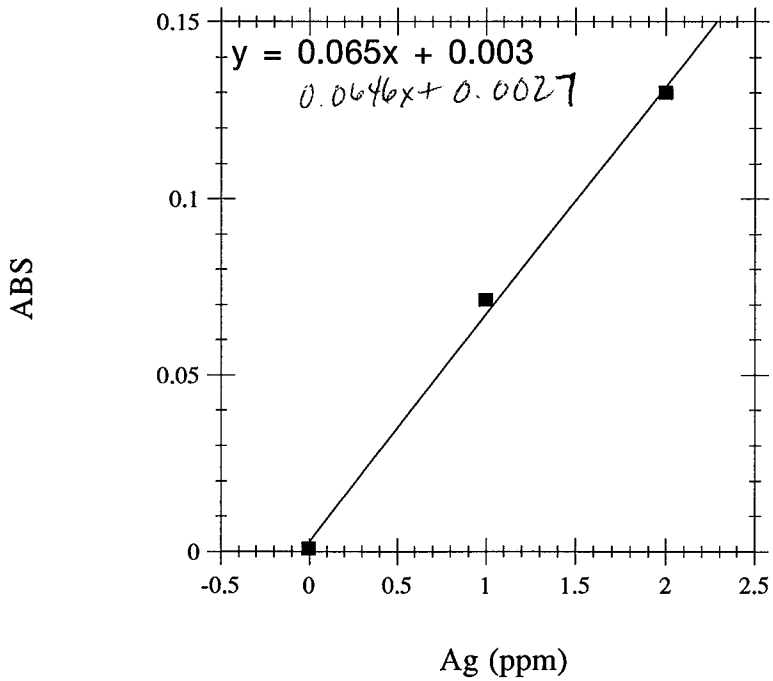
SAN-045 NH2OH



.0014 x 2 = .0028

$\frac{.0028 \times 8}{1.017} = .022$ ppm

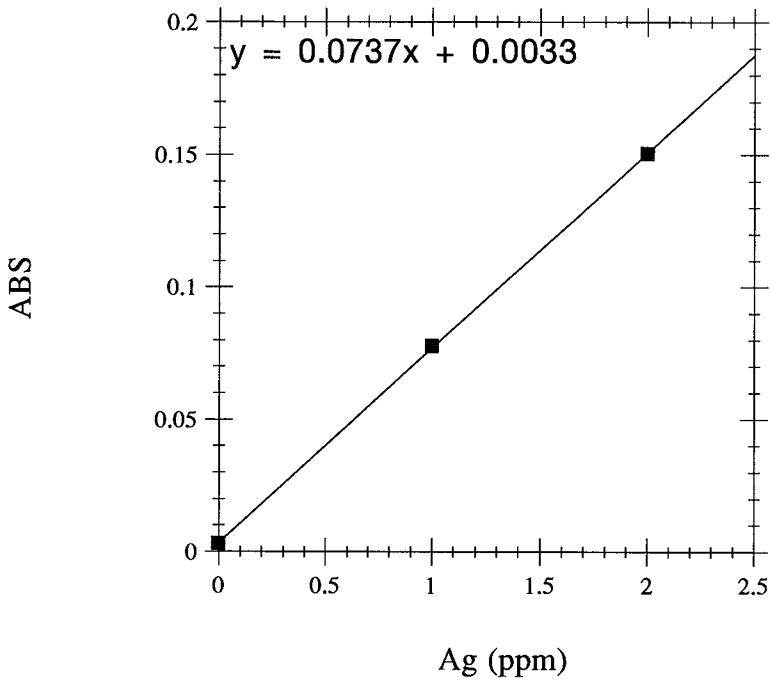
SAN-046 NH2OH



.0418 x 2 = .0836

$.0836 \times \frac{8}{1.022} = .654$ ppm

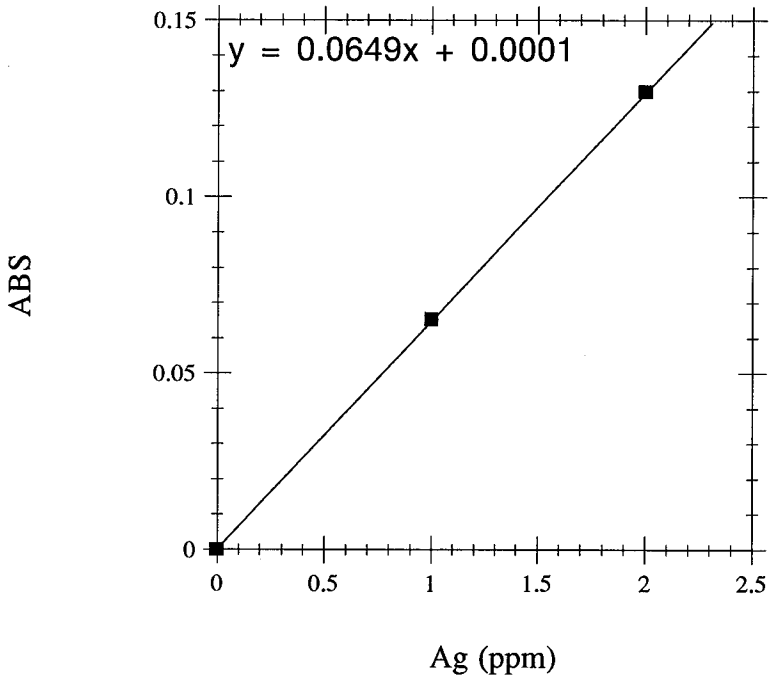
SAN-047 NH2OH



.0448 x 2 = .0896

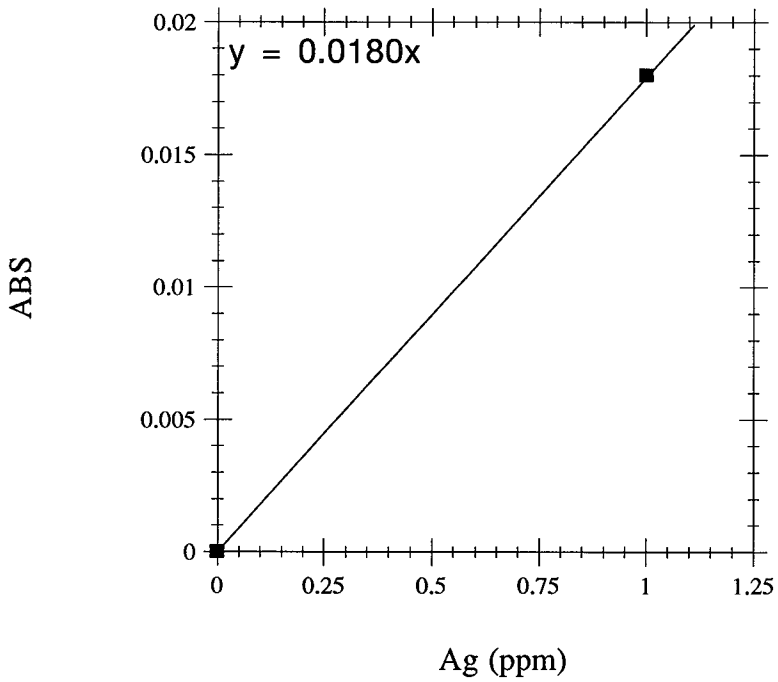
.0896 x 8 / 1.023 = .700 ppm

SAN-048 NH2OH

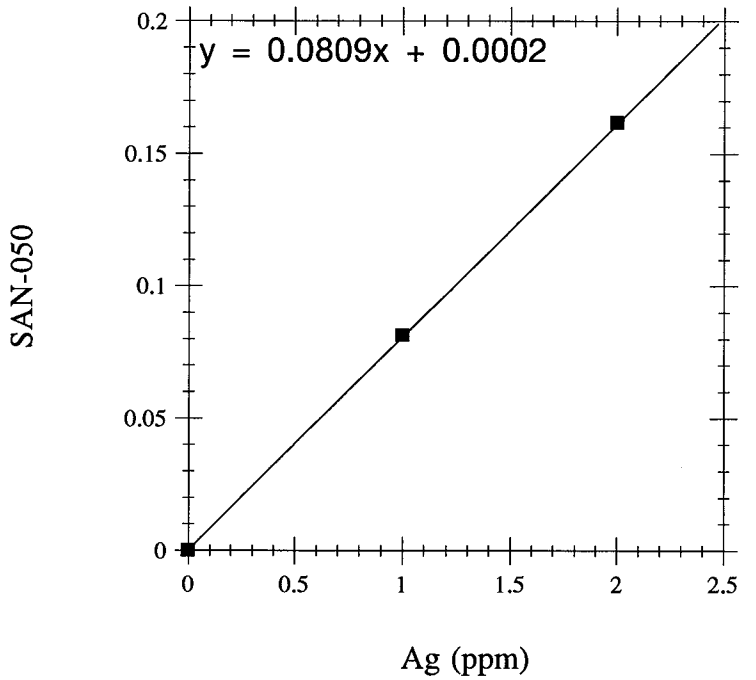


$.0015 \times 2 = .003 \times \frac{8}{1.022} = .023\ ppm$

SAN-049 NH2OH

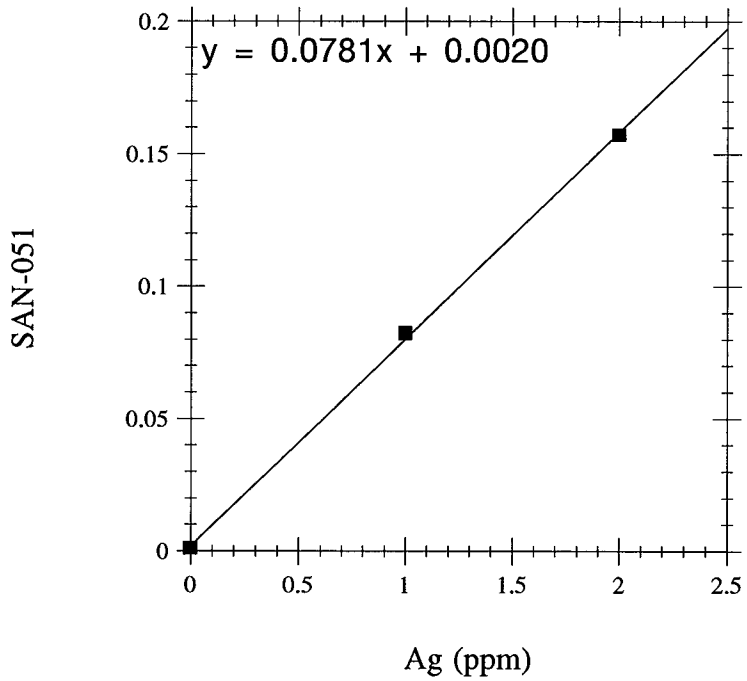


SAN-050 NH2OH



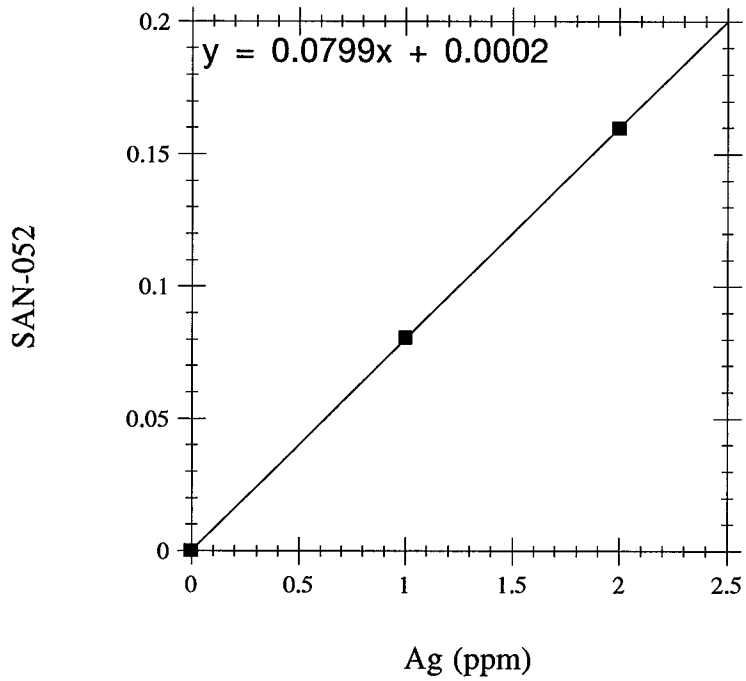
$.0025 \times 2 = .005 \times \frac{8}{1.016} = .041 ppm$

SAN-051 NH2OH



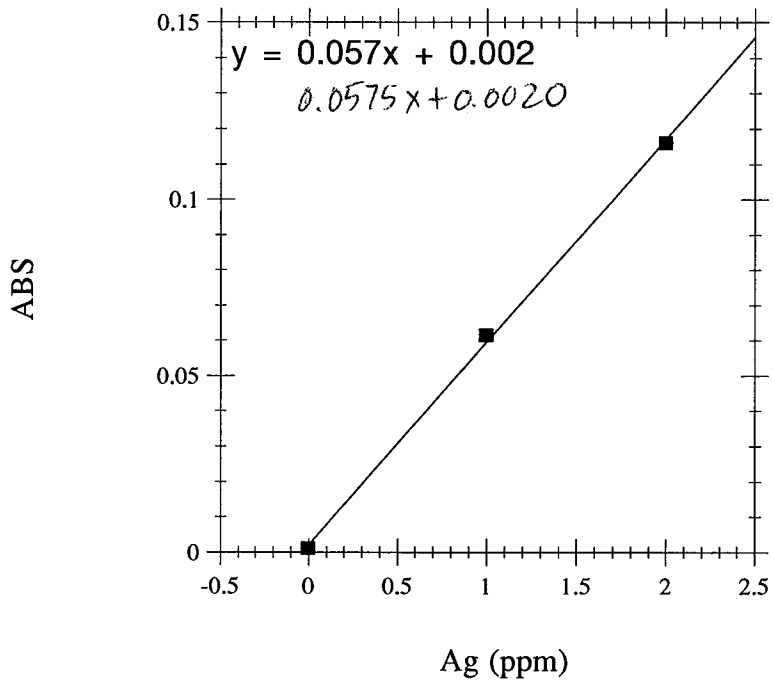
$.0256 \times 2 = .0512 \times \frac{8}{1.017} = .403 ppm$

SAN-052 NH2OH



$.0025 \times 2 = .005 \times \frac{8}{1.02} = .039$ ppm

SAN-053 NH2OH

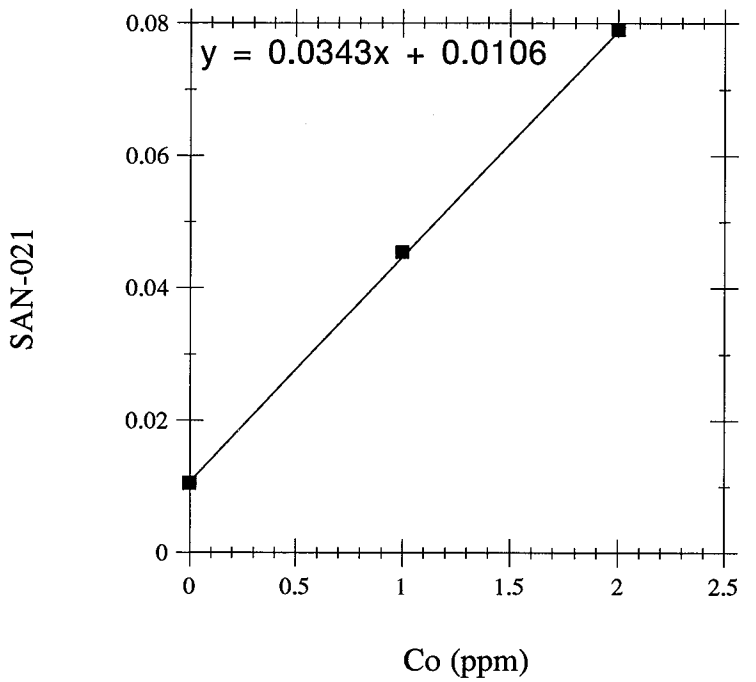


.0348x2 = .0696

$\frac{.0696 \times 8}{1.008} = .552$ ppm

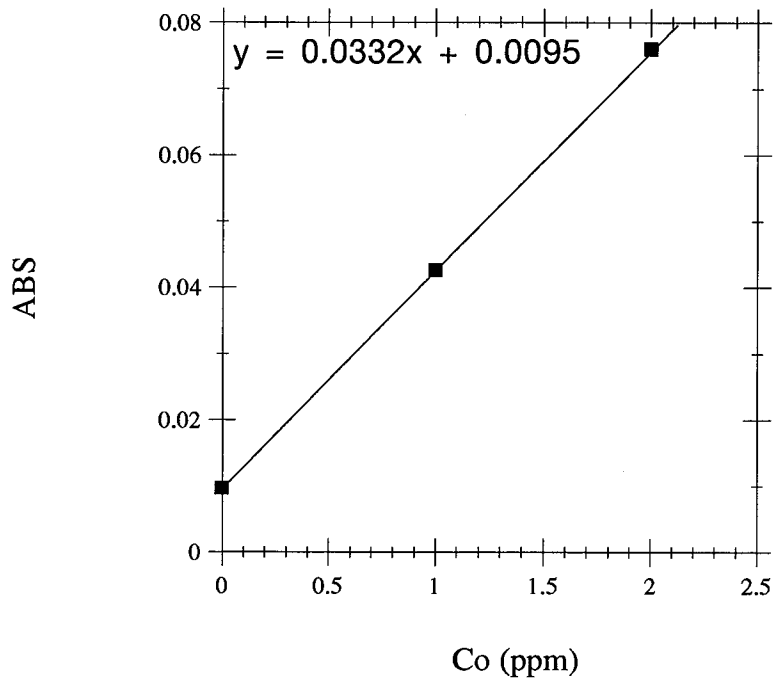
Co data

SAN-021 MgCl2



$.3090 \times 2 = .618 \times \frac{8}{1.016} = 4.866$ ppm

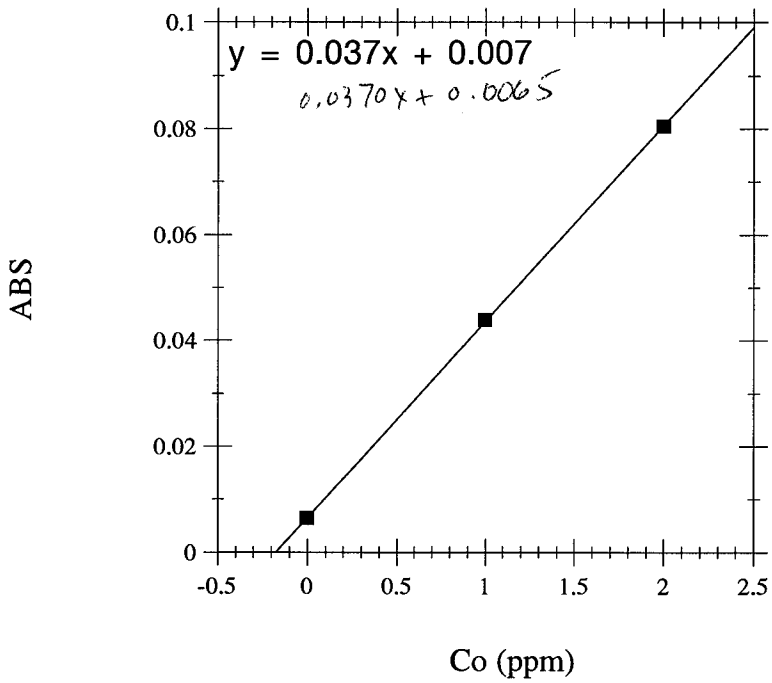
SAN-022 MgCl2



.2861 x 2 = .5722

$.5722 \times \frac{8}{1.022} = 4.479 \text{ ppm}$

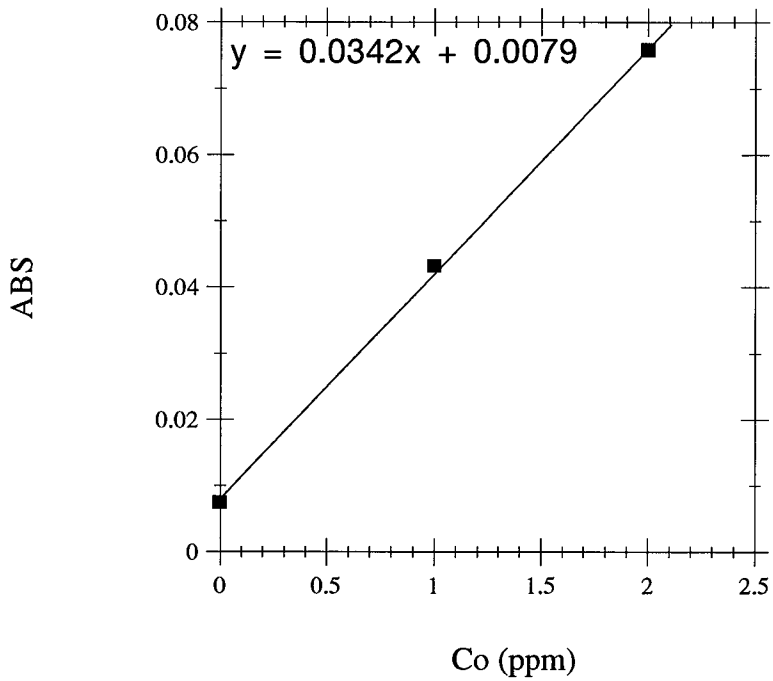
SAN-023 MgCl2



.1757 x 2 = .3514

.3514 x 8/1.022 = 2.751 ppm

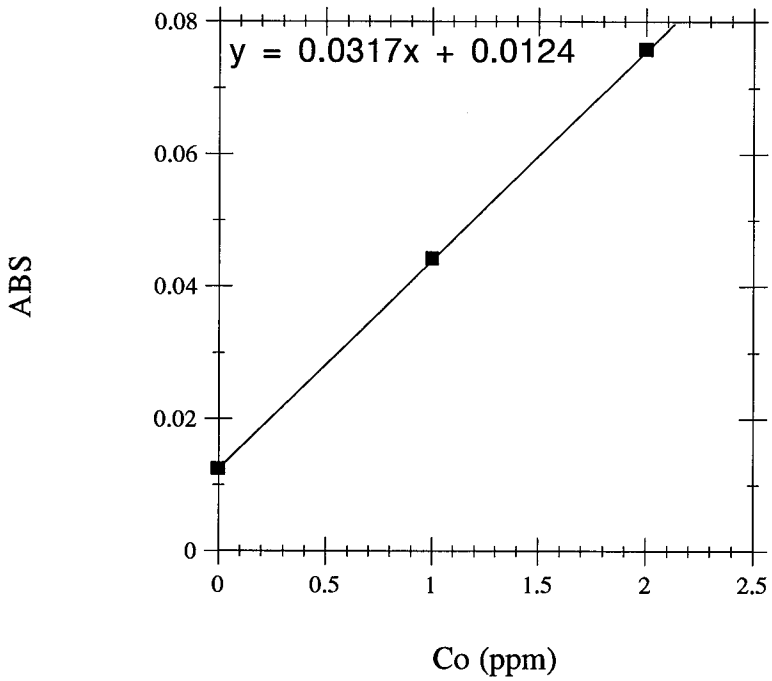
SAN-024 MgCl2



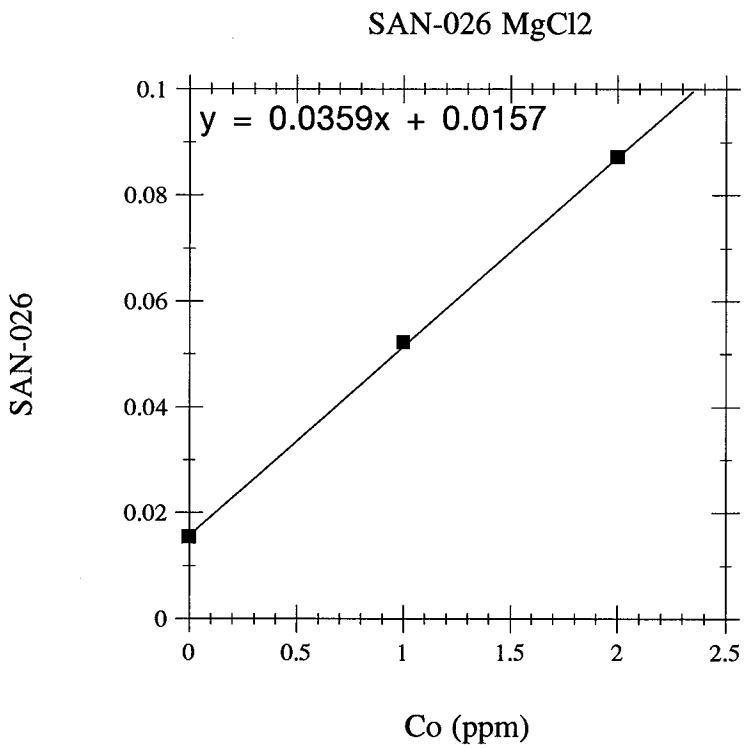
.2310 x 2 = .4620

.462 x 8/1.018 = 3.631 ppm

SAN-025 MgCl2

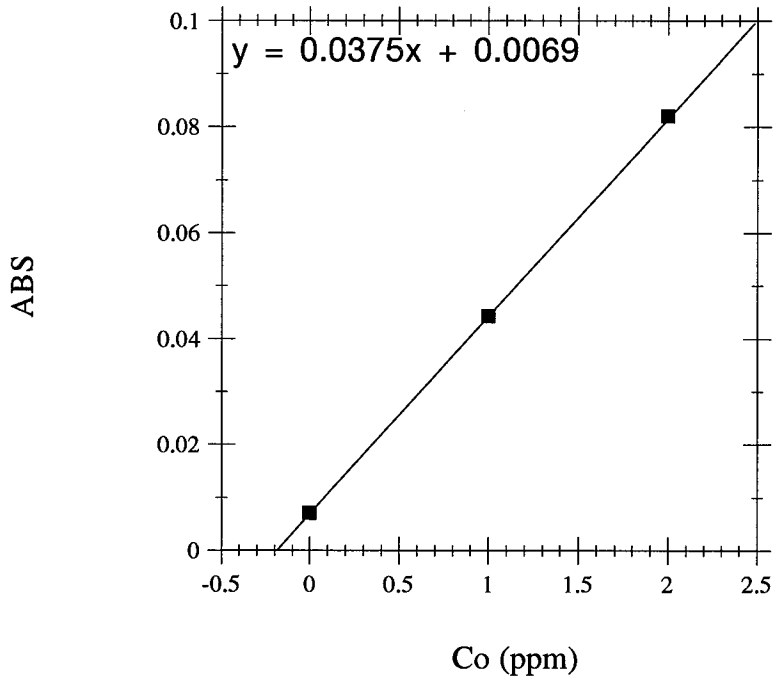


$.3912 \times 2 = .7824 \times \frac{8}{1.025} = 6.106$ ppm



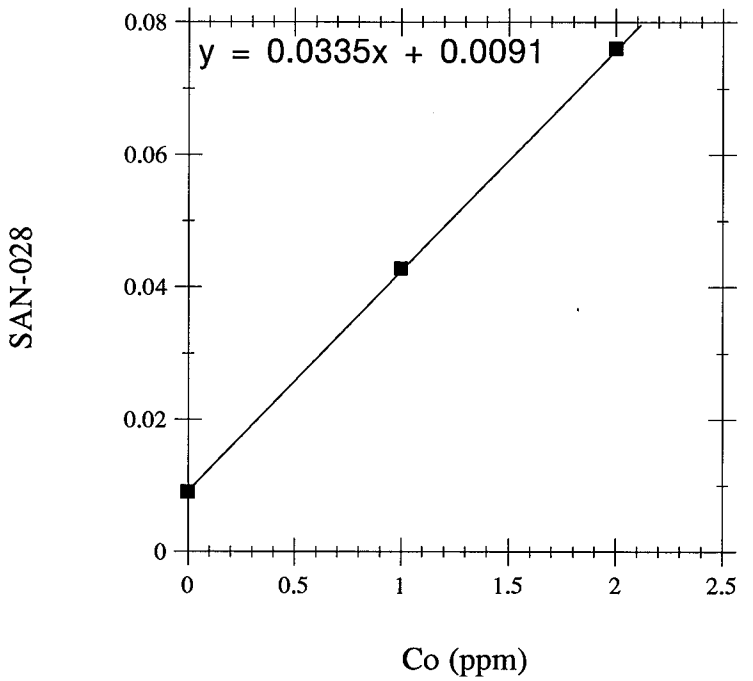
$.4373 \times 2 = .8746 \times \frac{8}{1.021} = 6.853 \text{ ppm}$

SAN-027 MgCl2



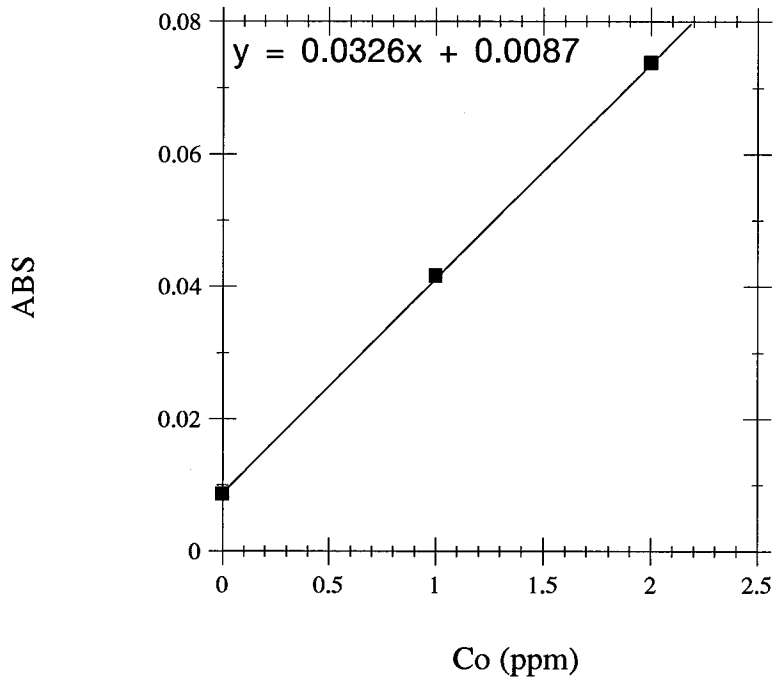
$0.184 \times 2 = .368 \times \frac{8}{1013} = 2.906$ ppm

SAN-028 MgCl2



$.2716 \times 2 = .5432 \times \frac{8}{1.023} = 4.248\text{ppm}$

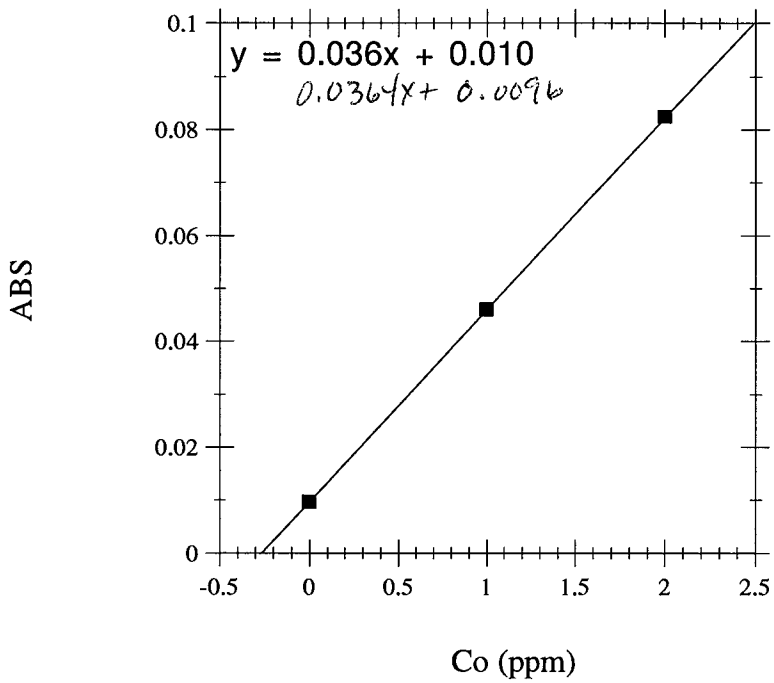
SAN-029 MgCl2



.2669 x 2 = .5338

$.5338 \times \frac{8}{1.02} = 4.187$ ppm

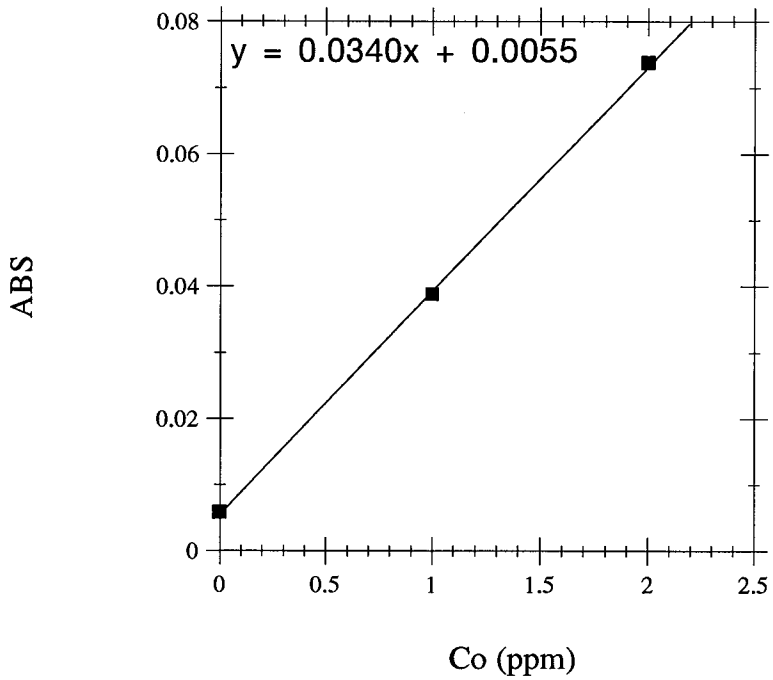
SAN-030 MgCl2



.2637 × 2 = .5274

$.5274 \times \frac{8}{1.022} = \underline{4.128 \text{ ppm}}$

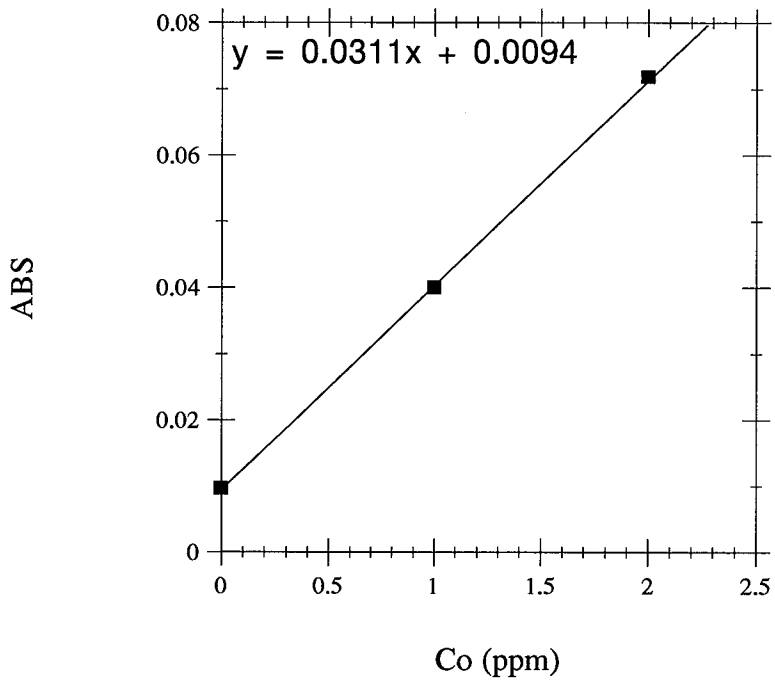
SAN-031 MgCl2



.1618 x 2 = .3236

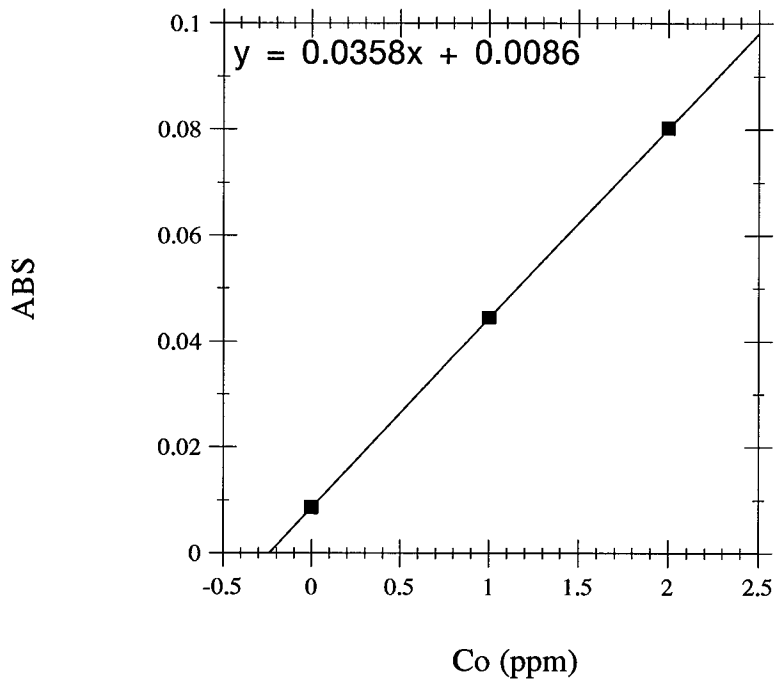
$.3236 \times \frac{8}{1.026} = 2.523$ ppm

SAN-032 MgCl2



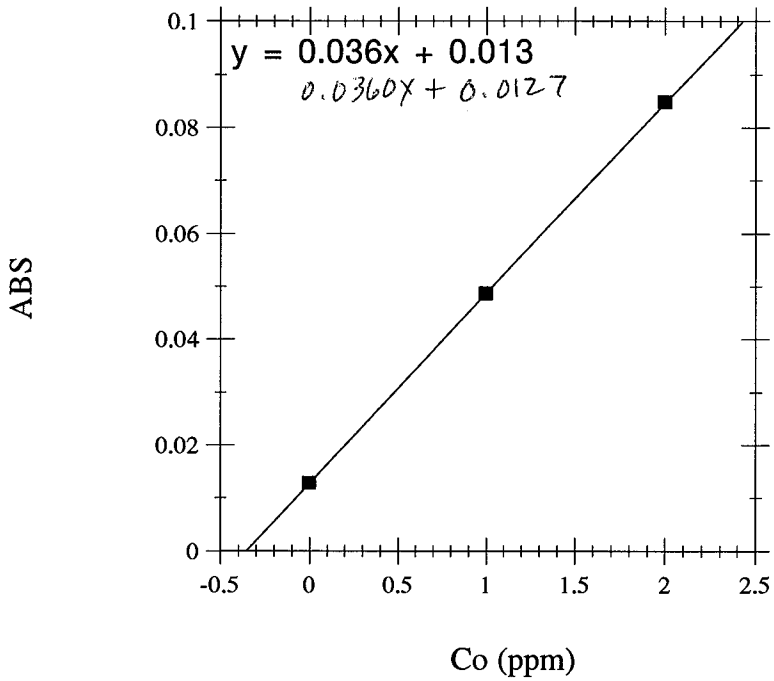
$.3022 \times 2 = .6044 \times \frac{8}{1.017} = 4.754$ ppm

SAN-033



.2402 x 2 = .4804 x 8/1.012 = 3.798 ppm

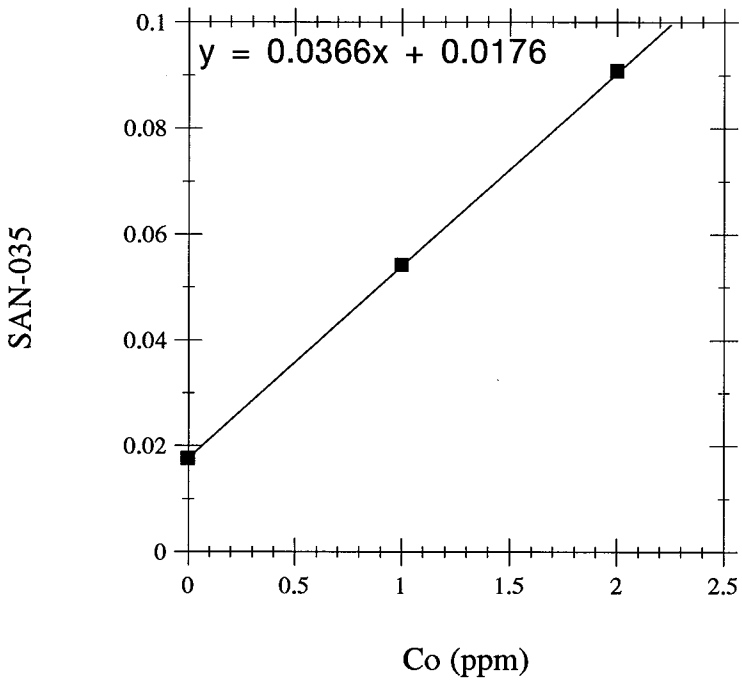
SAN-034 MgCl2



.3528 ×2

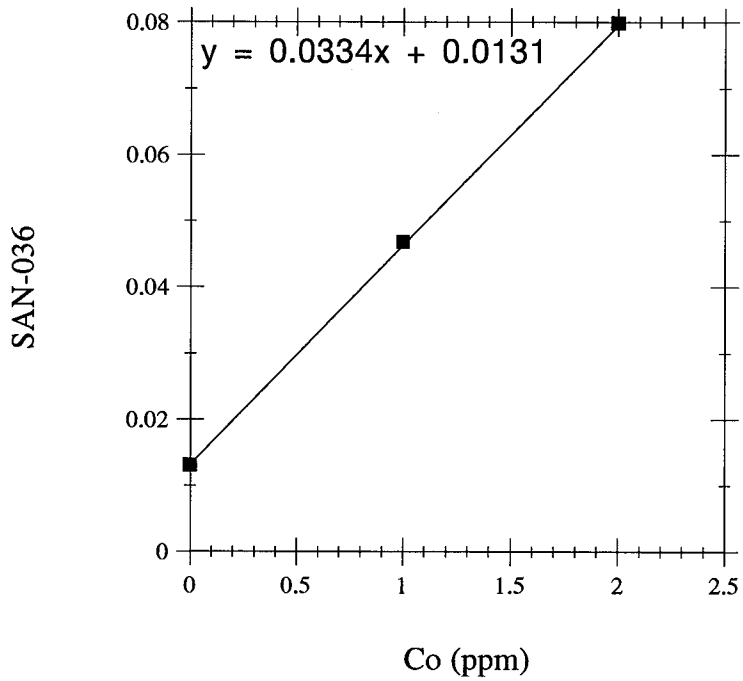
.7056 × 8/1.009 = 5.594 ppm

SAN-035 MgCl2



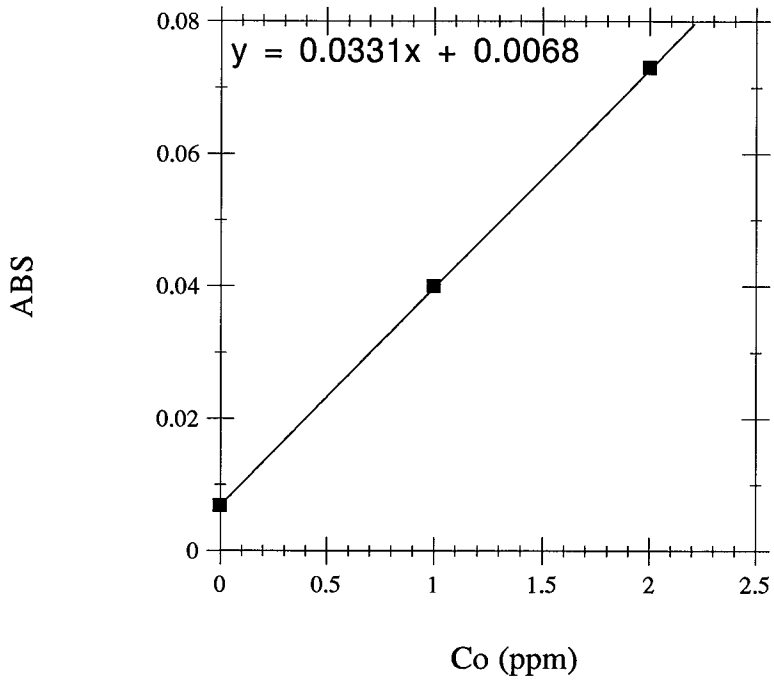
$.4809 \times 2 = .9618 \times \frac{8}{1.02} = 7.543 ppm$

SAN-036 MgCl2



.3922 x 2 = .7844 x 8/1.014 = 6.188 ppm

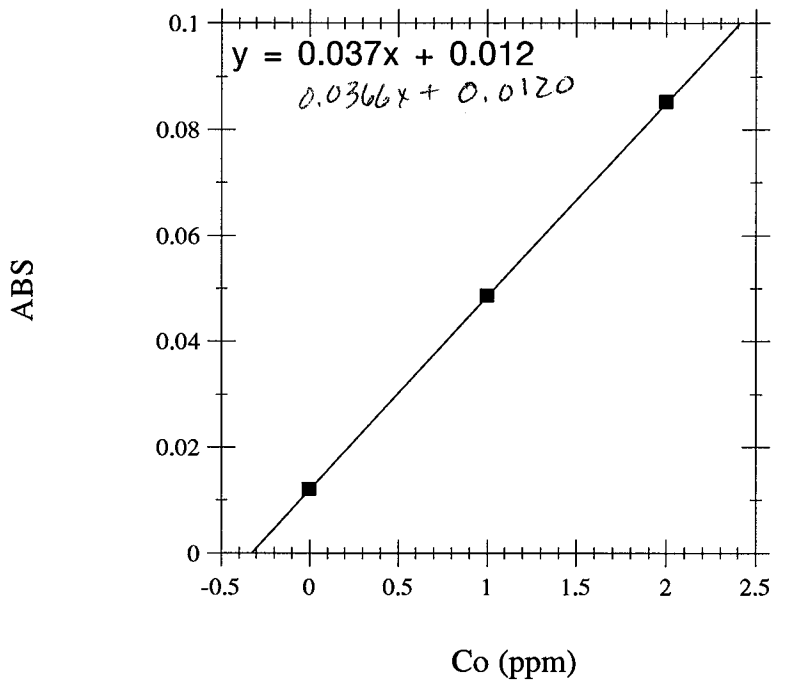
SAN-037 MgCl2



.2054 x 2 = .4108

$\frac{.4108 \times 8}{1.021} = 3.219$ ppm

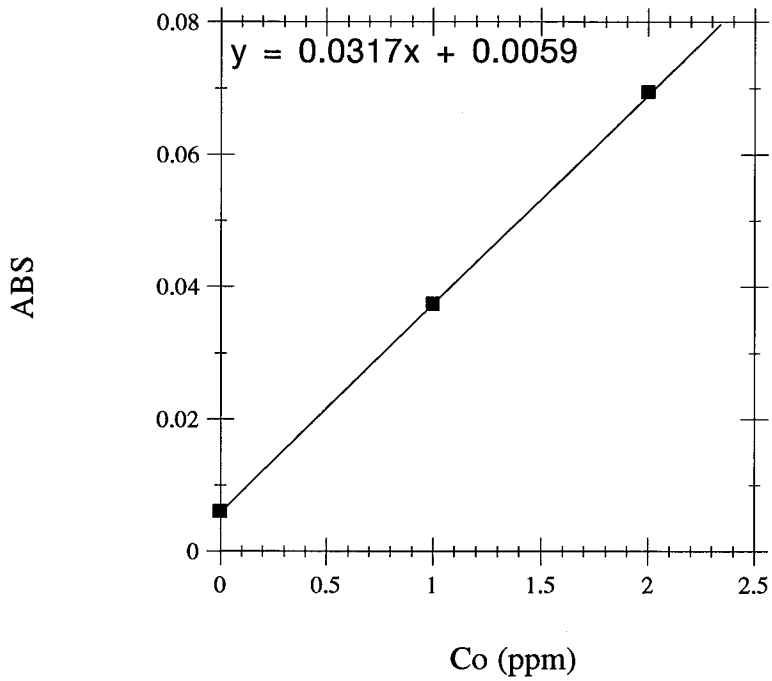
SAN-038 MgCl2



.3278 x 2 = .6556

.6556 x 8/1.024 = 5.122 ppm

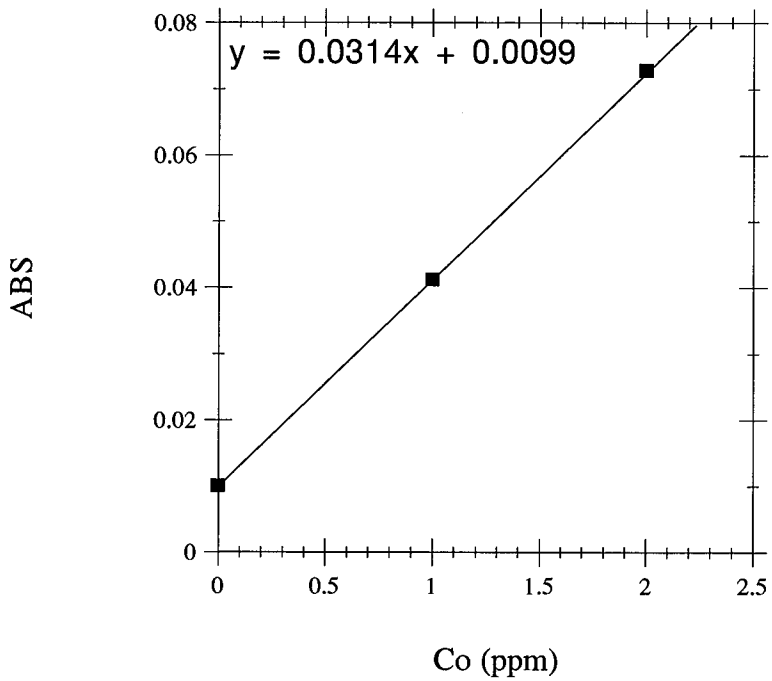
SAN-039 MgCl2



.1861 x2 = .3722

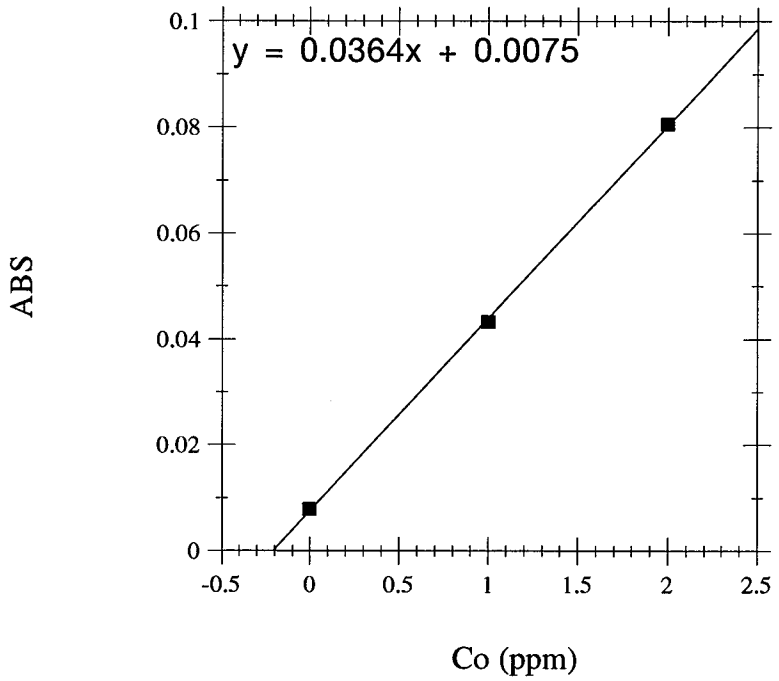
$\frac{.3722 + 8}{1.018} = 2.925$ ppm

SAN-040 MgCl2



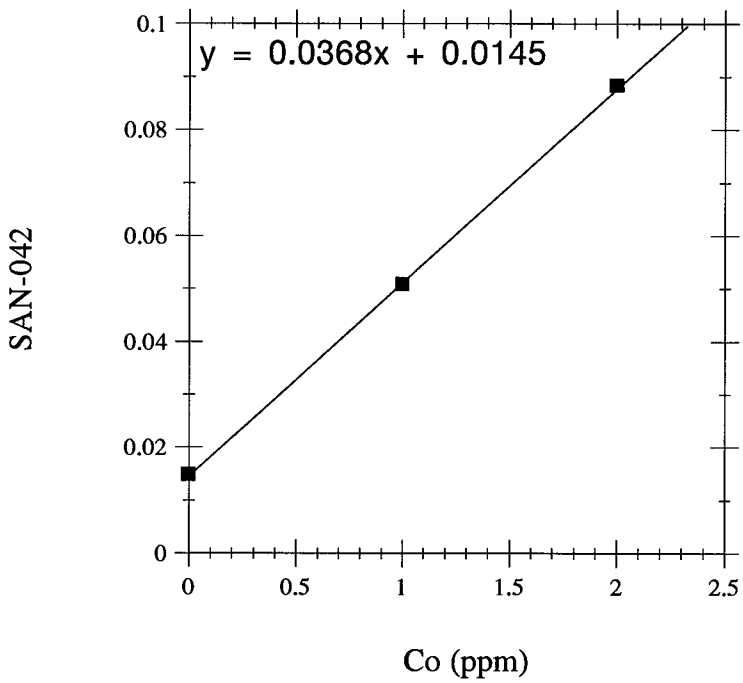
$.3153 \times 2 = \cancel{.60}\ .6306 \times \frac{8}{1.017} = 4.960\ ppm$

SAN-041 MgCl2



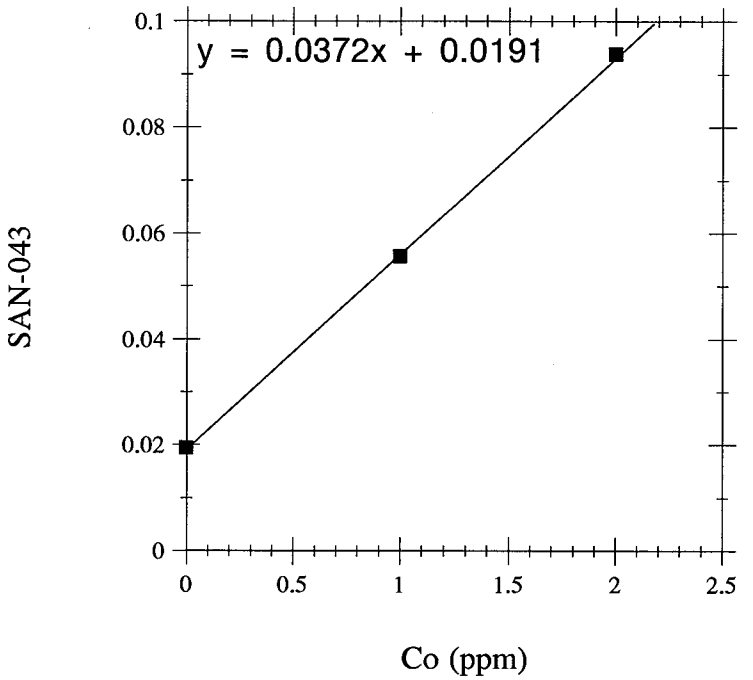
$.206 \times 2 = .412 \times \frac{8}{1.015} = 3.247$ ppm

SAN-042 MgCl2



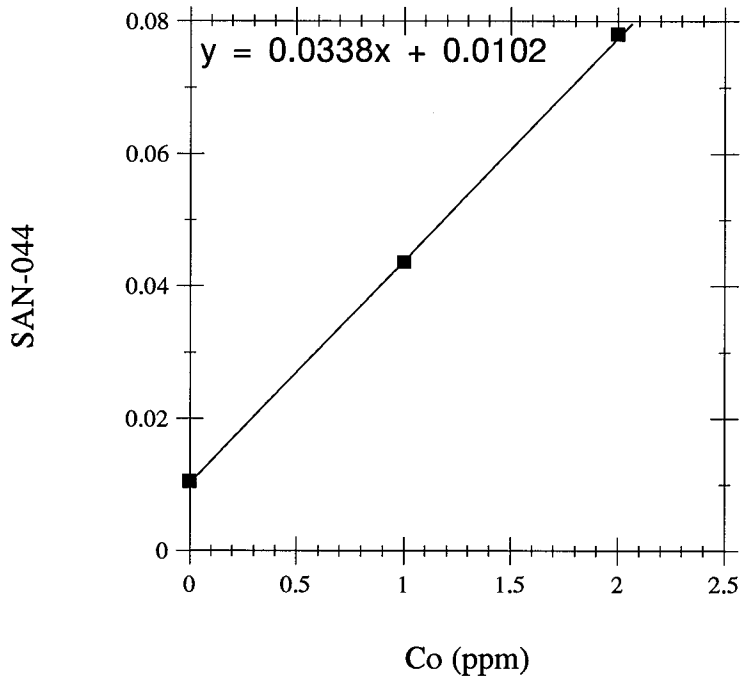
.3940 x2 = .788 x 8/1.012 = 6.23 ppm

SAN-043 MgCl2



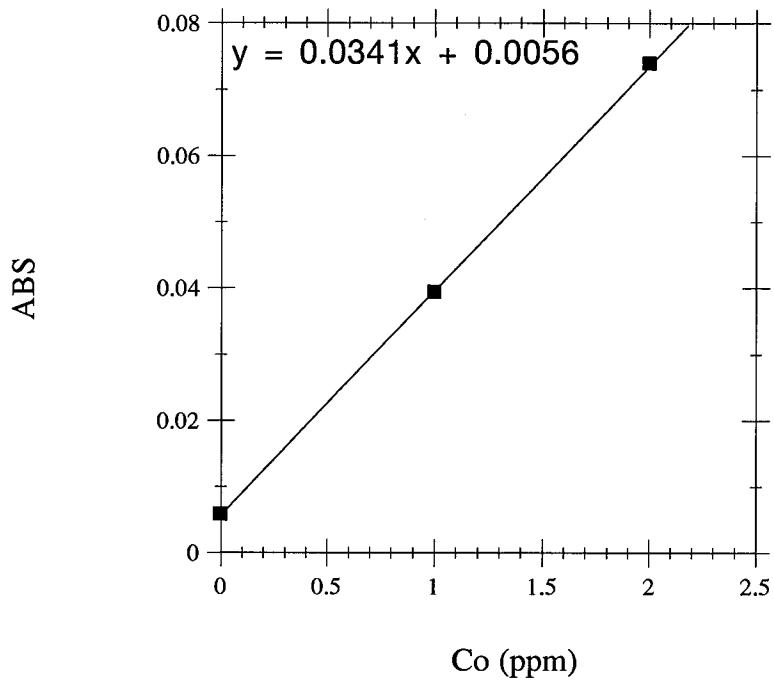
$.5134 \times 2 = 1.0268 \times \frac{8}{1.022} = 8.038\ ppm$

SAN-044 MgCl2



$.3018 \times 2 = .6036 \times \frac{8}{1.014} = 4.762$ ppm

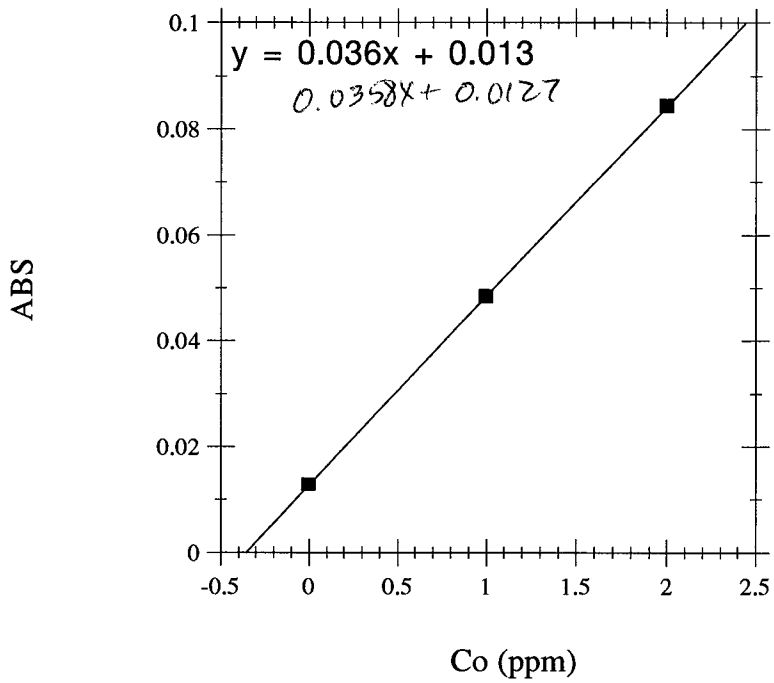
SAN-045 MgCl2



.1642 x 2 = .3284

$\frac{.3284 \times 8}{1.017} = 2.583$ ppm

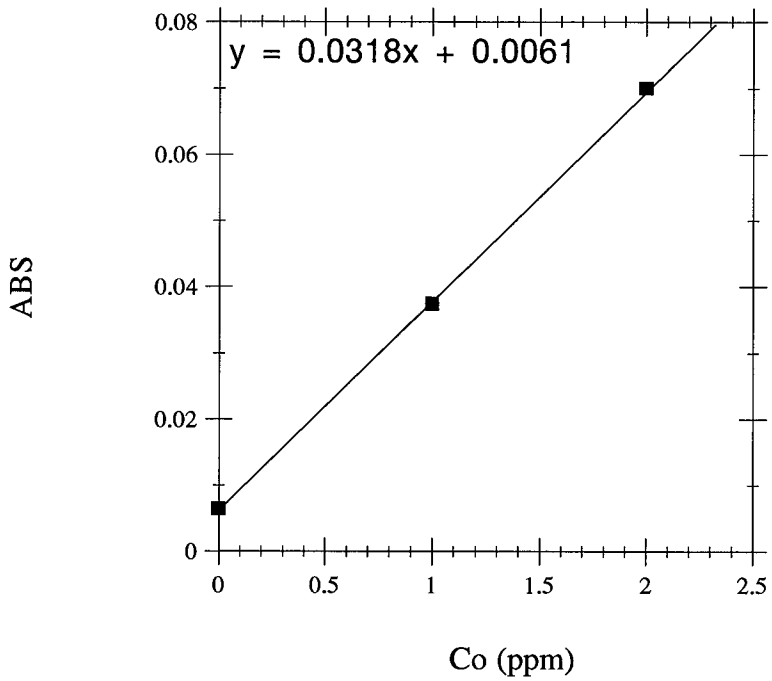
SAN-046 MgCl2



.3547 x2 = .7094

.7094 x 8 / 1.022 = 5.553 ppm

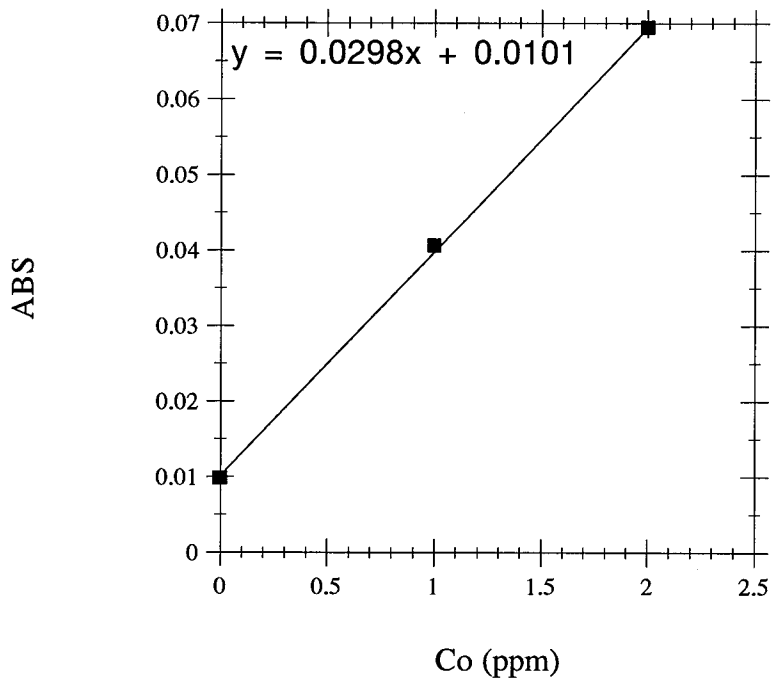
SAN-047 MgCl2



.1918 x 2 = .3836

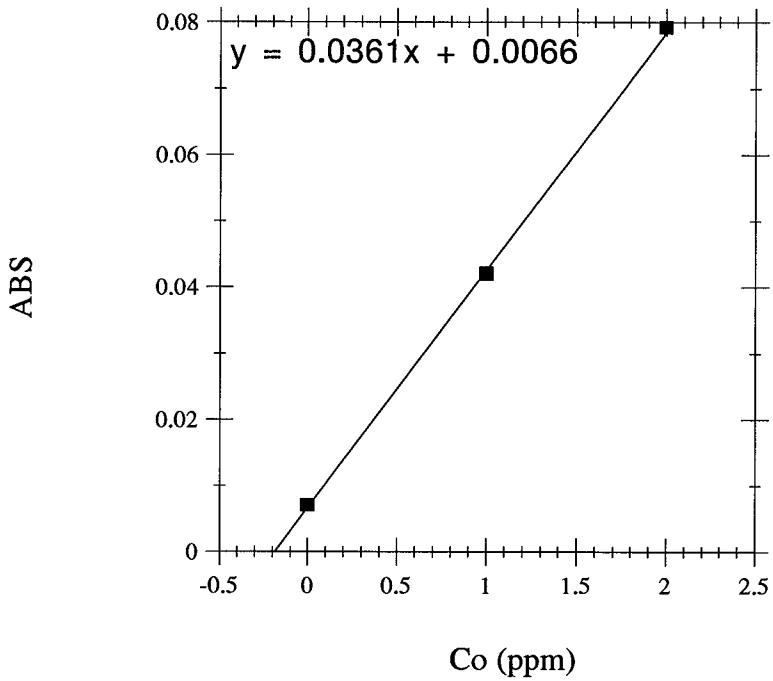
$.3836 \times \frac{8}{1.023} = 2.999$ ppm

SAN-048 MgCl2



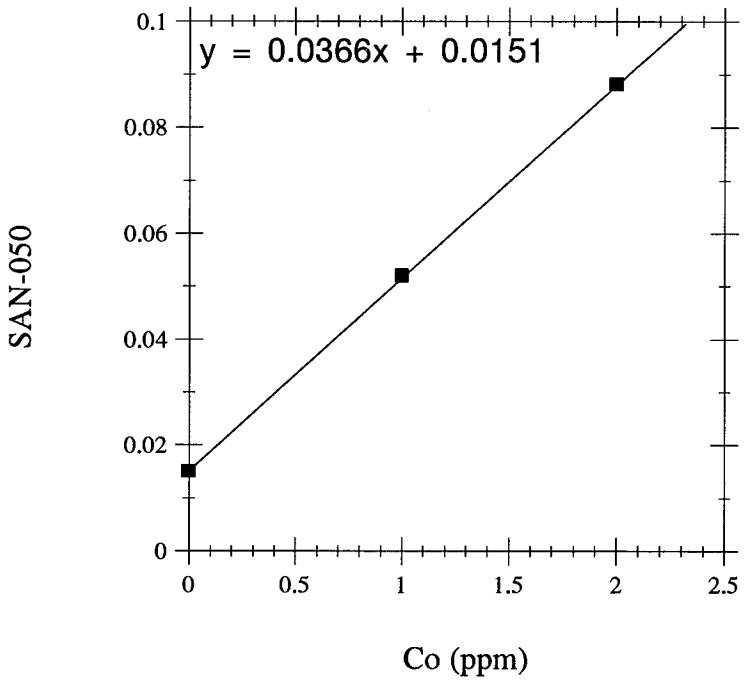
~~.38~~ .3389 x 2 = .6778 x 8 / 1.022 = 5.306 ppm

SAN-049 MgCl2



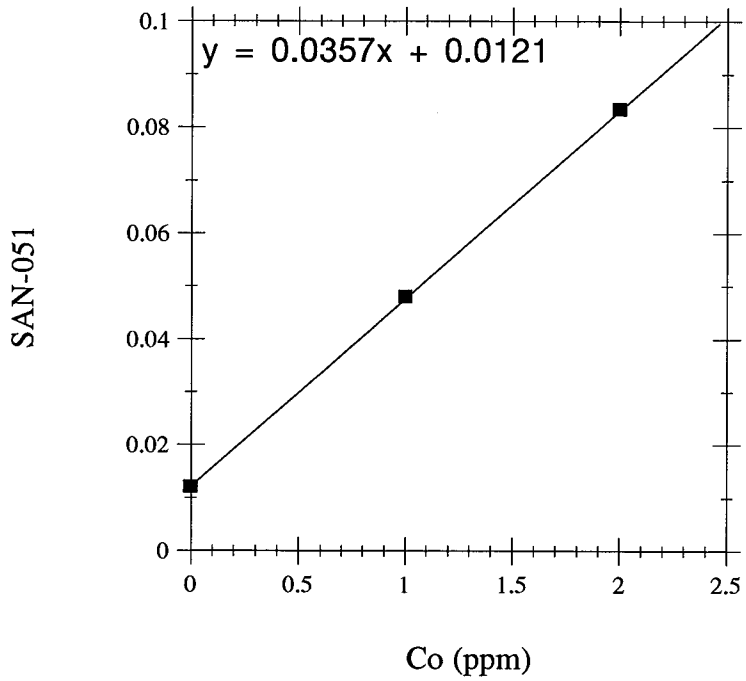
$.1828 \times 2 = .3656 \times \frac{8}{1.017} = 2.876$ ppm

SAN-050 MgCl2

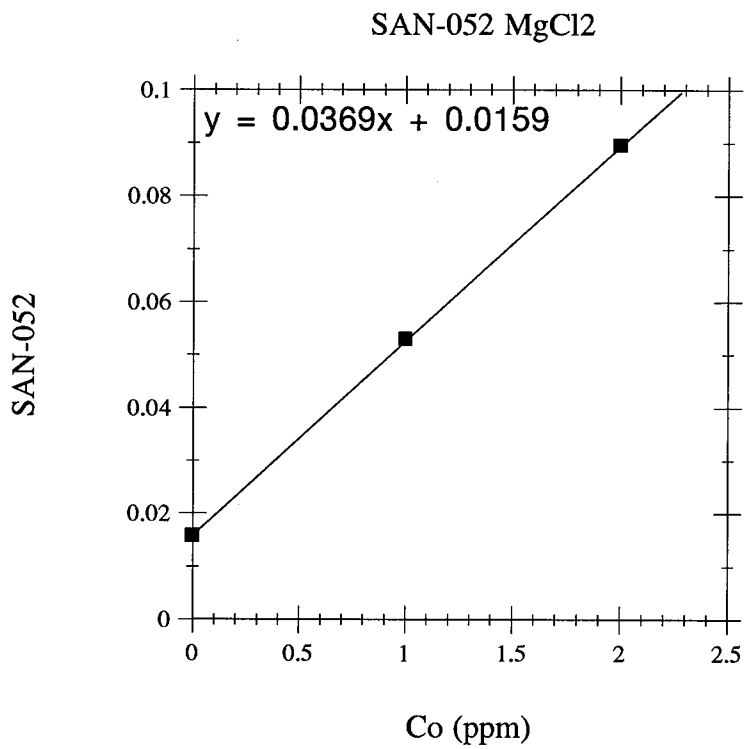


$.4126 \times 2 = .8252 \times \frac{8}{1.016} = 6.498$ ppm

SAN-051 MgCl2

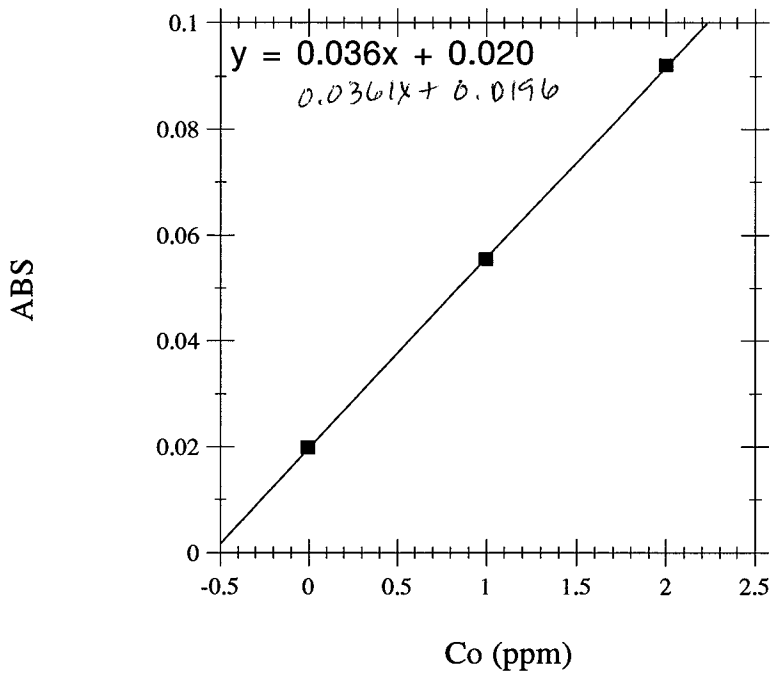


$.3389 \times 2 = .6778 \times \frac{8}{1.017} = 5.332$ ppm



$.4309 \times 2 = .8618 \times \frac{8}{1.02} = 6.759$ ppm

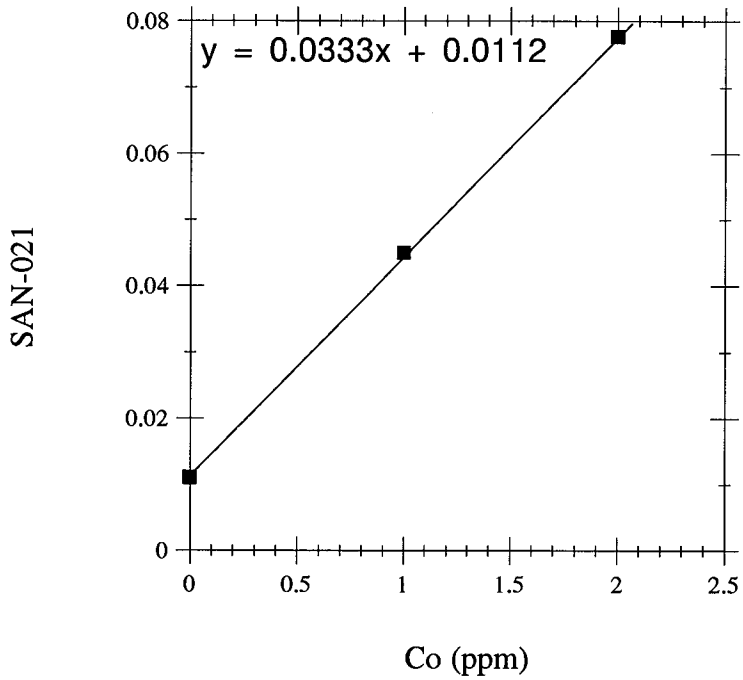
SAN-053 MgCl2



.5429 × 2 = 1.0858

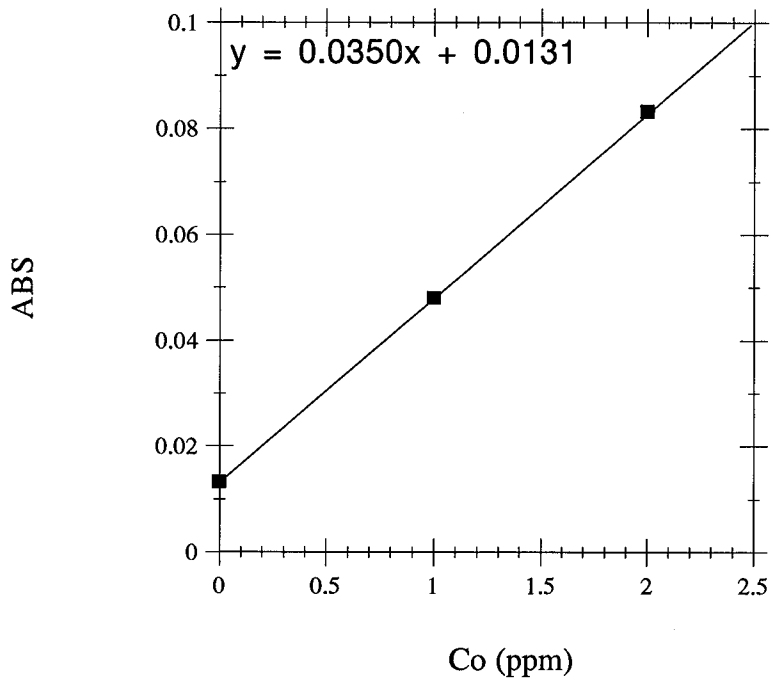
1.0858 × 8 / 1.008 = 8.617 ppm

SAN-021 NaOAc



.3363 x 2 = .6726 x 8/1.016 = 5.296 ppm

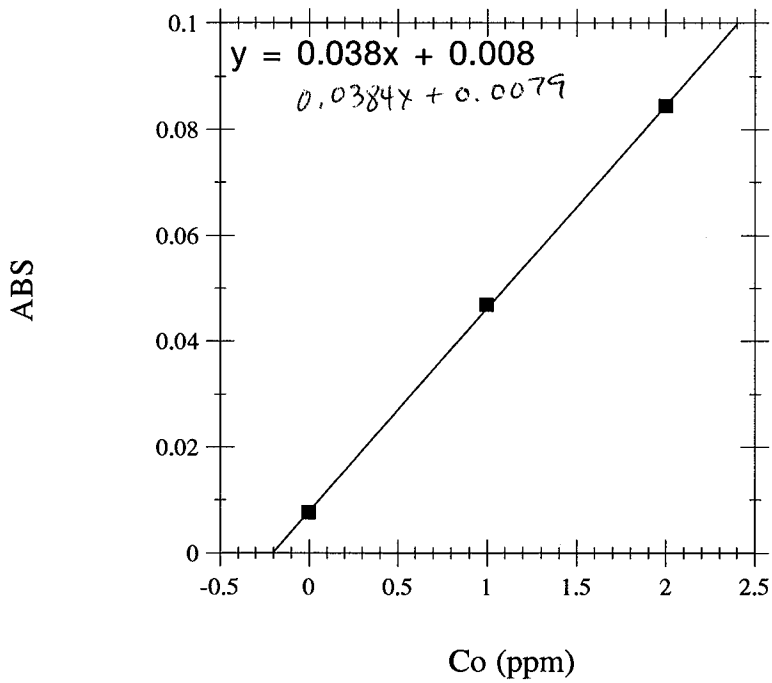
SAN-022 NaOAc



.3743 x 2 = .7486

$.7486 \times \frac{8}{1.022} = \underline{5.860 \text{ ppm}}$

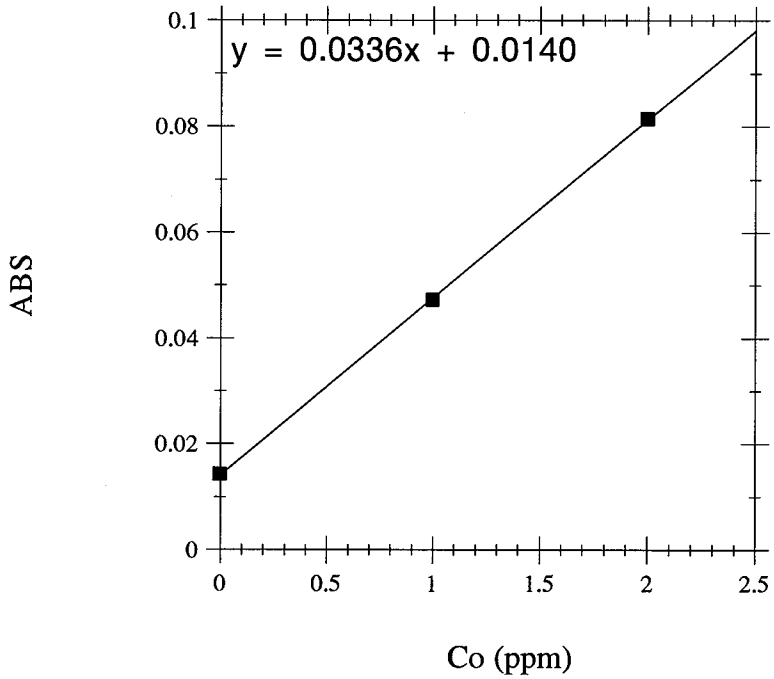
SAN-023 NaOAc



.2057 x2 = .4114

$.4114 \times \frac{8}{1.022} = 3.22$ ppm

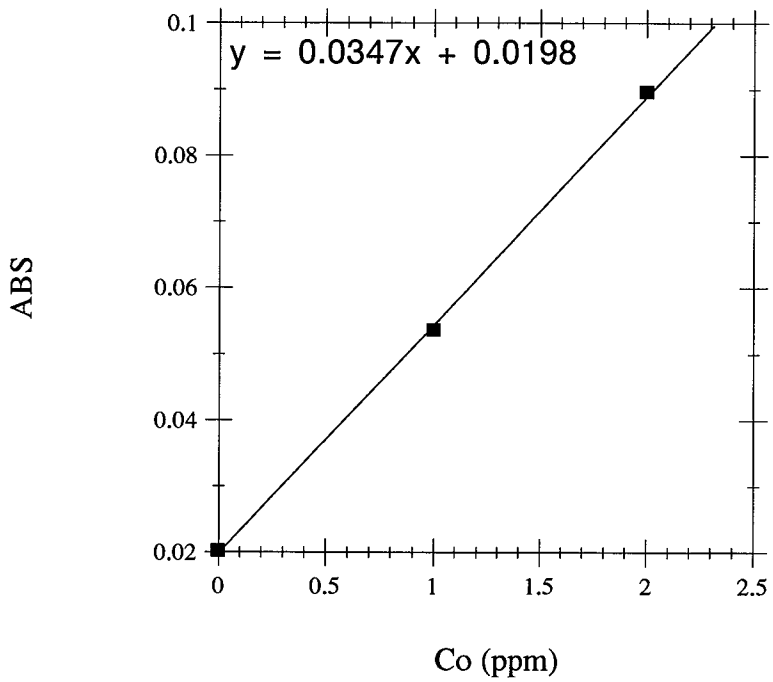
SAN-024 NaOAc



.4167 x 2 = .8334

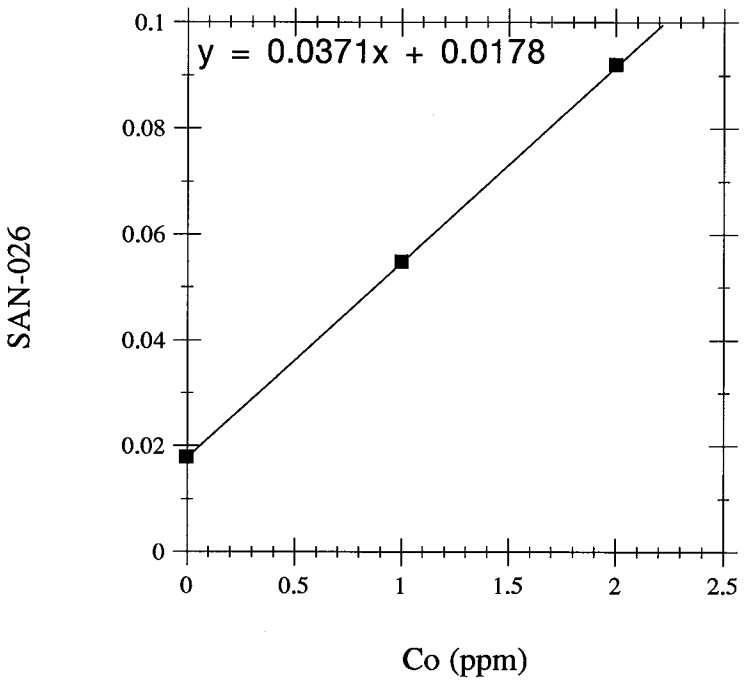
$\frac{.8334 \times 8}{1.018} = 6.549$ ppm

SAN-025 NaOAc



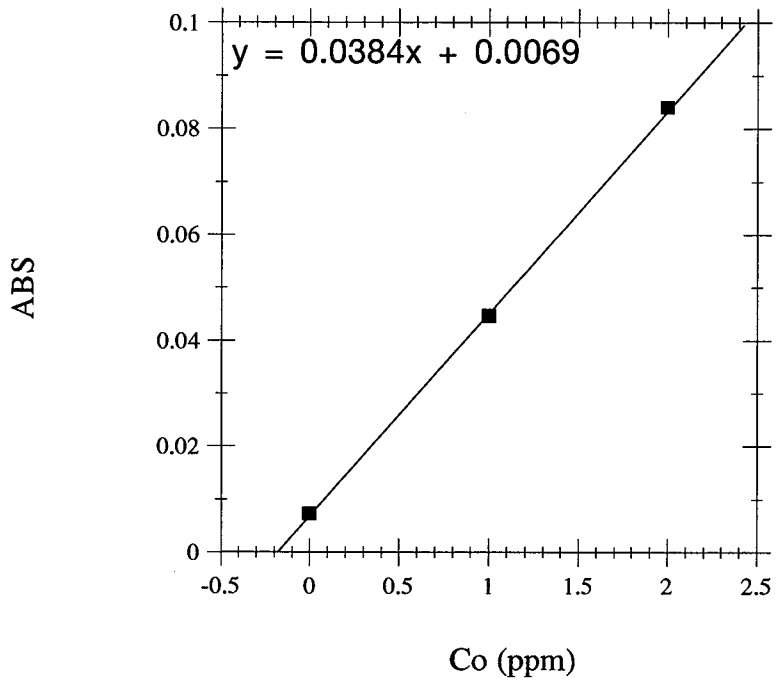
$.5706 \times 2 = 1.1412 \times \frac{8}{1.025} = 8.907$ ppm.

SAN-026 NaOAc



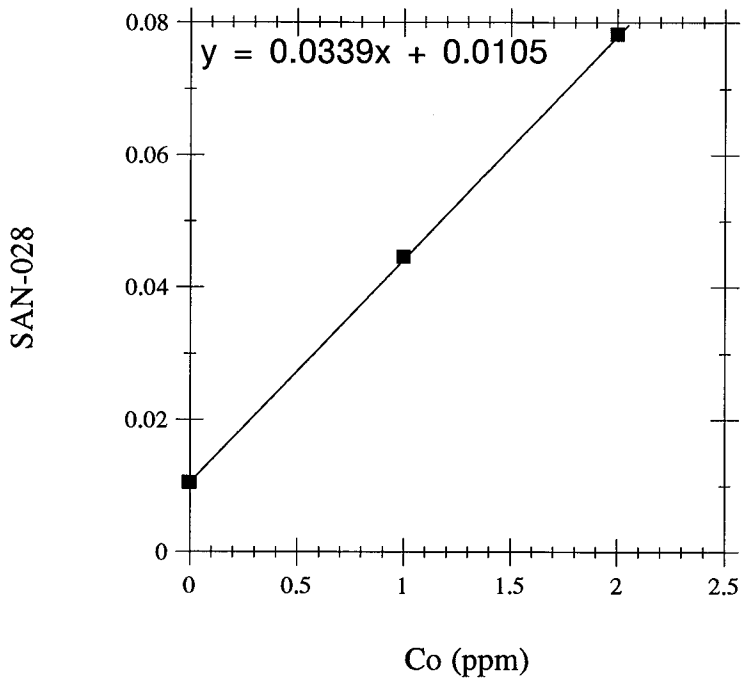
.4798x2 = .9596 x 8/1.021 = 7.519ppm

SAN-027 NaOAc



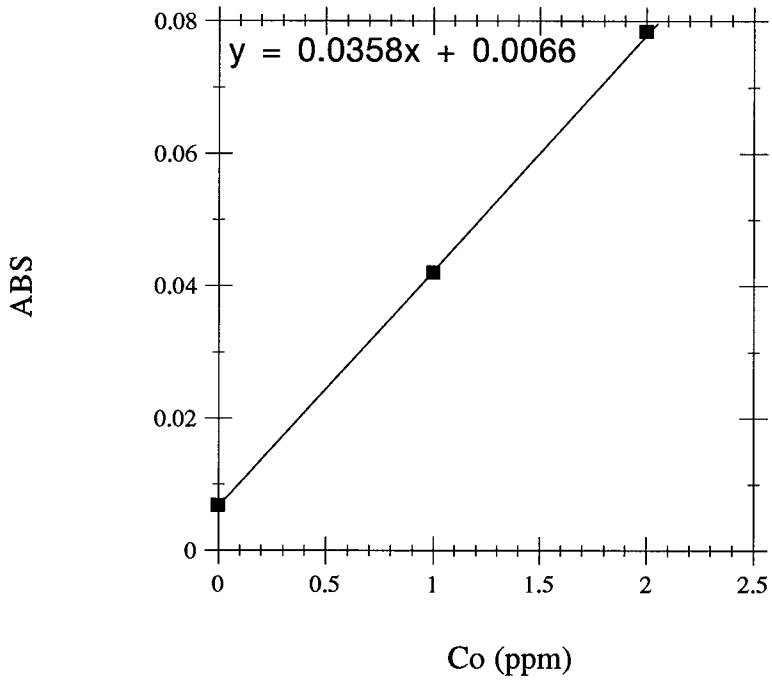
$.1797 \times 2 = .3594 \times \frac{8}{1.013} = \underline{2.838 \text{ ppm}}$

SAN-028 NaOAc



.3097x2= .6194 x 8/1.023 = 4.844ppm

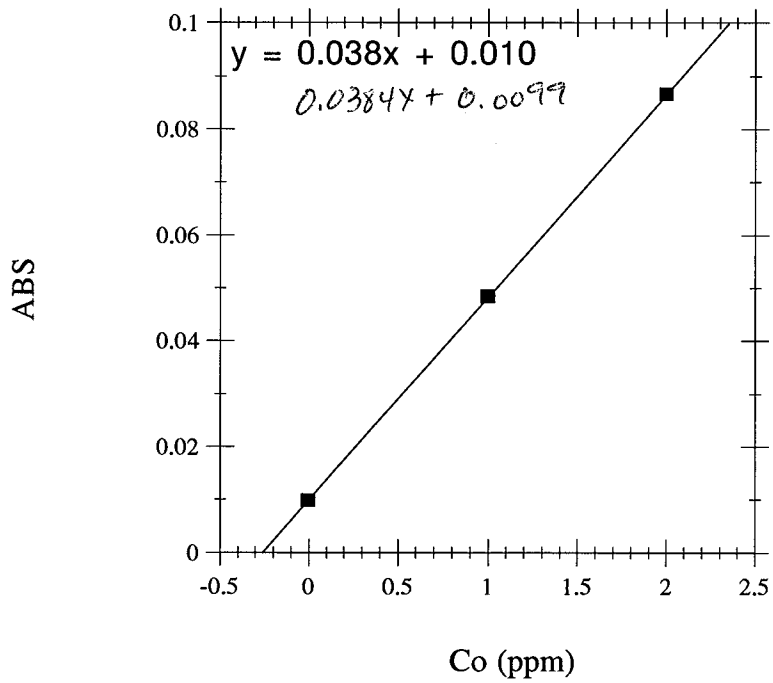
SAN-029 NaOAc



.1844 x 2 = .3688

$\frac{.3688 \times 8}{1.02} = 2.892$ ppm

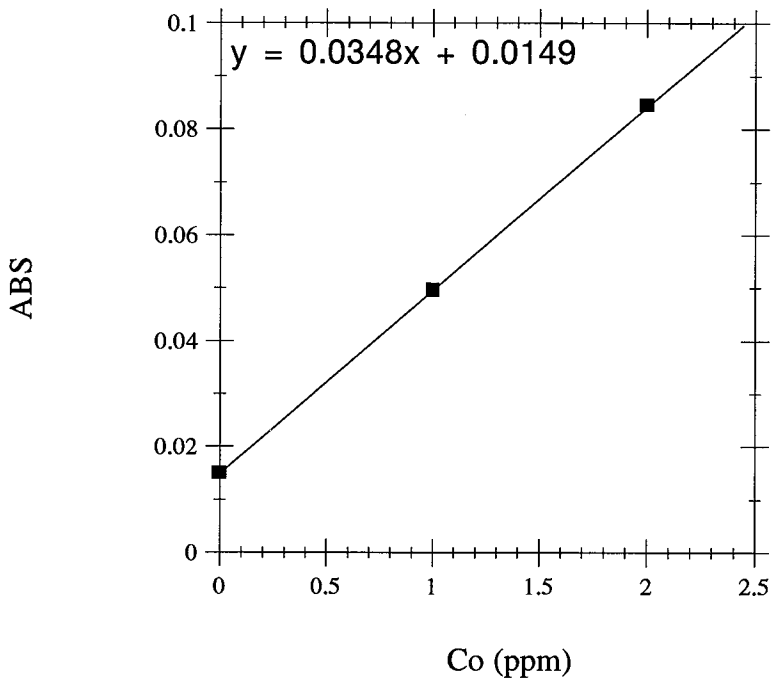
SAN-030 NaOAc



.2578 x 2 = .5156

$.5156 \times \frac{8}{1.022} = 4.036$ ppm

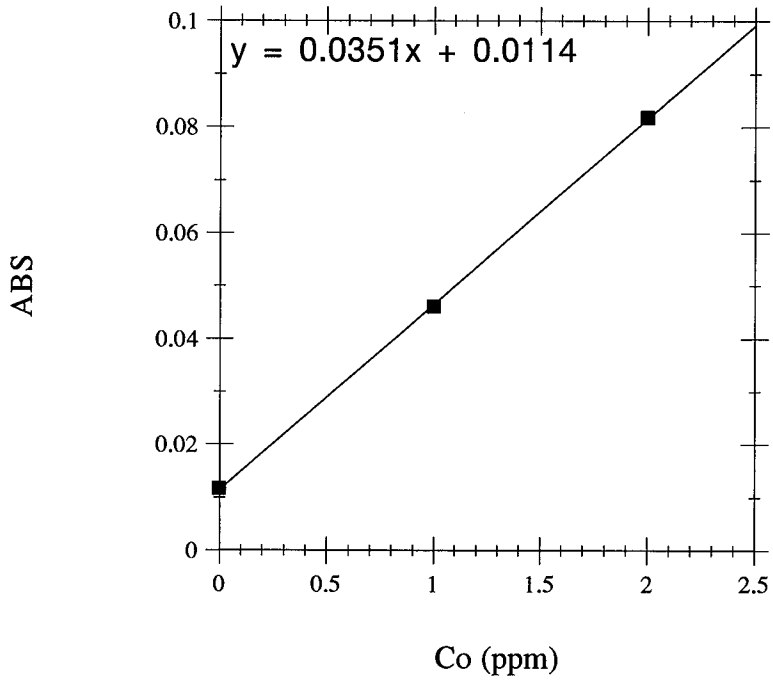
SAN-031 NaOAc



.4282 x 2 = .8564

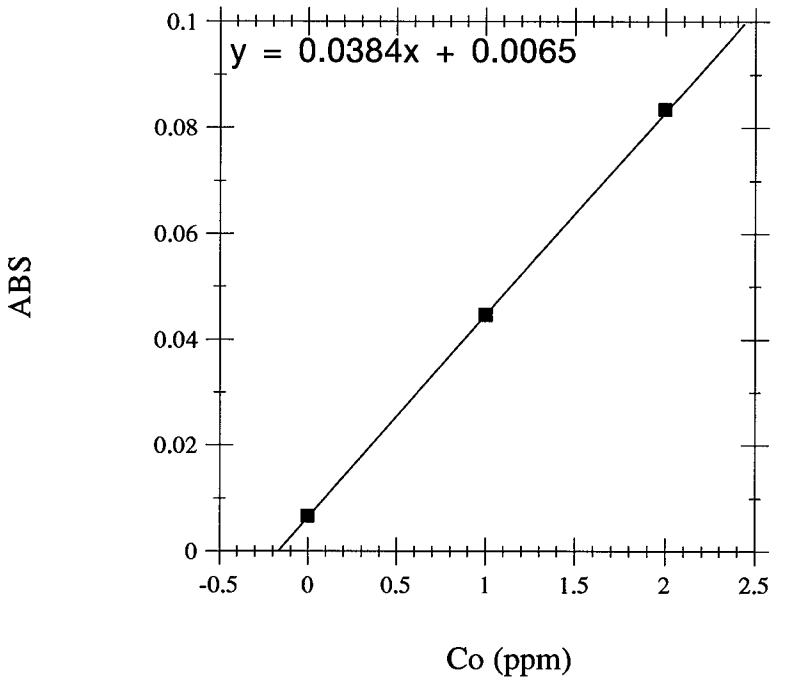
.8564 x 8/1.026 = 6.677 ppm

SAN-032 NaOAc



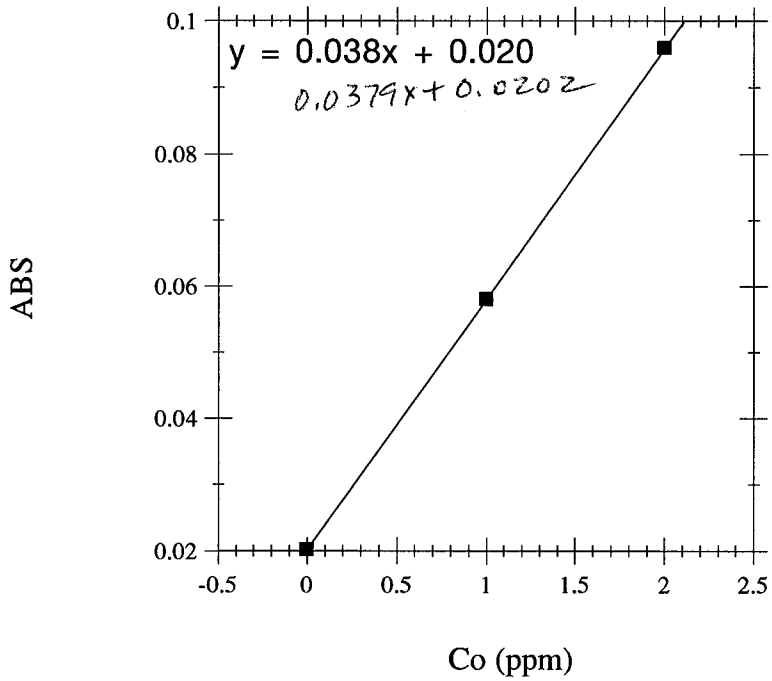
$.3248 \times 2 = .6496 \times \frac{8}{1.017} = \cancel{5.10}\ \underline{5.11\ ppm}$

SAN-033 NaOAc



$.1693 \times 2 = .3386 \times \frac{8}{1.012} = \underline{2.677 \text{ ppm}}$

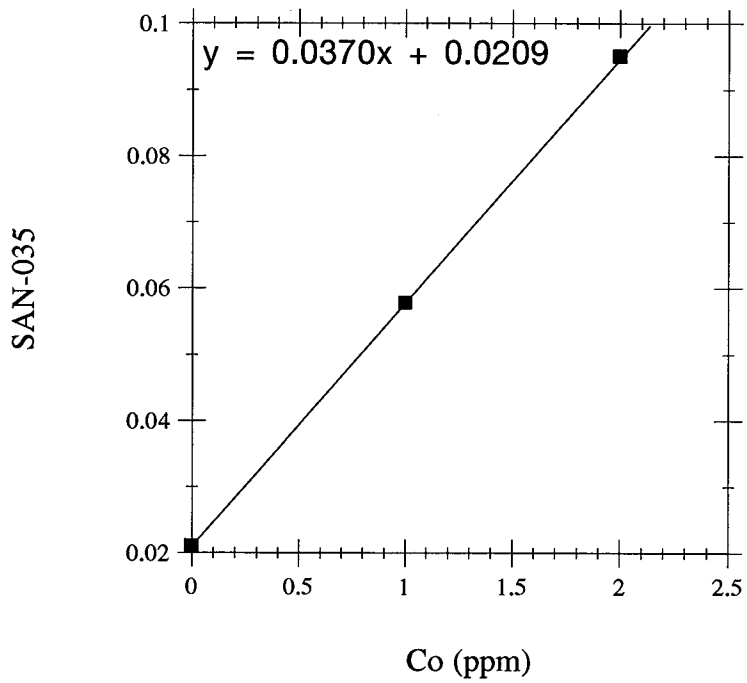
SAN-034 NaOAc



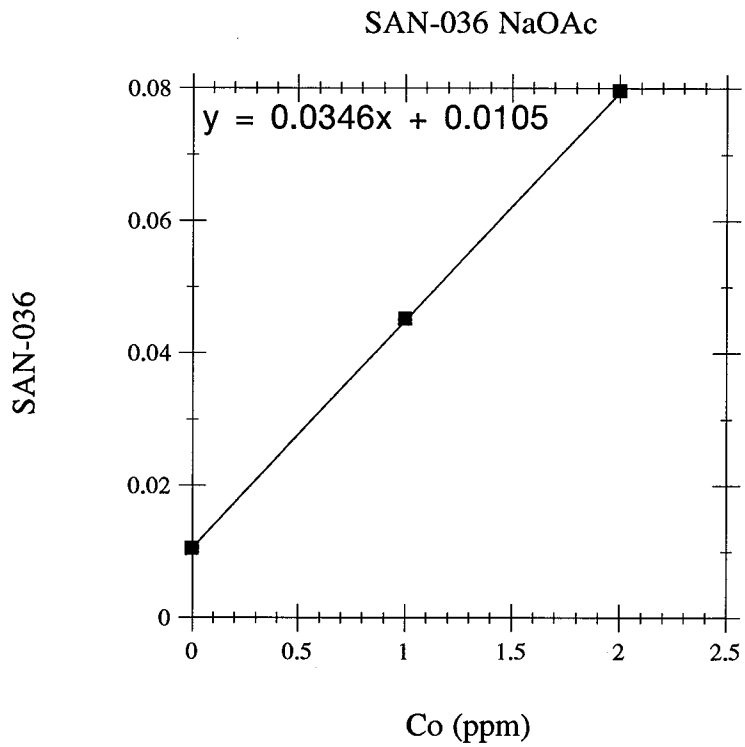
.533 x2 = 1.066

$1.066 \times \frac{8}{1.009} = 8.452$ ppm

SAN-035 NaOAc

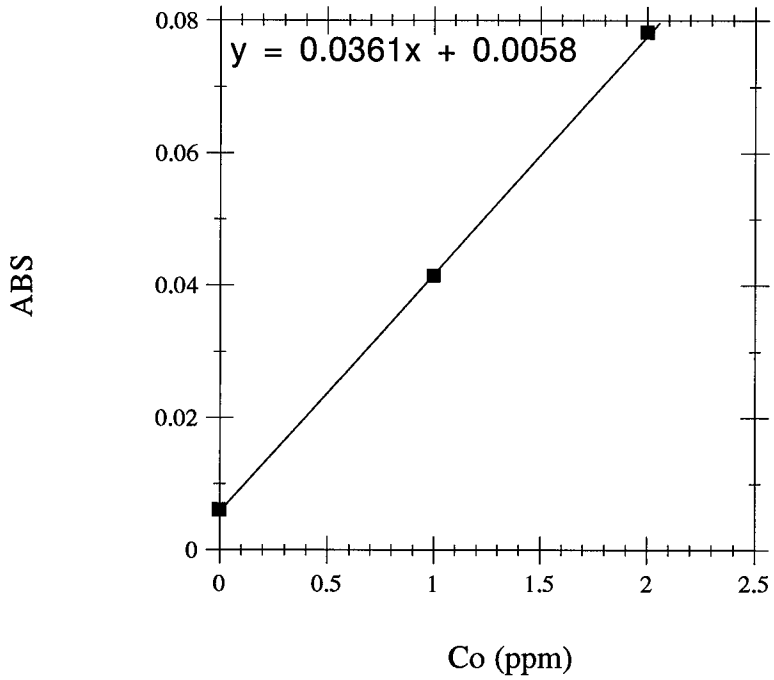


$.5649 \times 2 = 1.1298 \times \frac{8}{1.02} = 8.861$ ppm



$.3035 \times 2 = \frac{.607 \times 8}{1.014} = \cancel{4.80}\ 4.789$ ppm

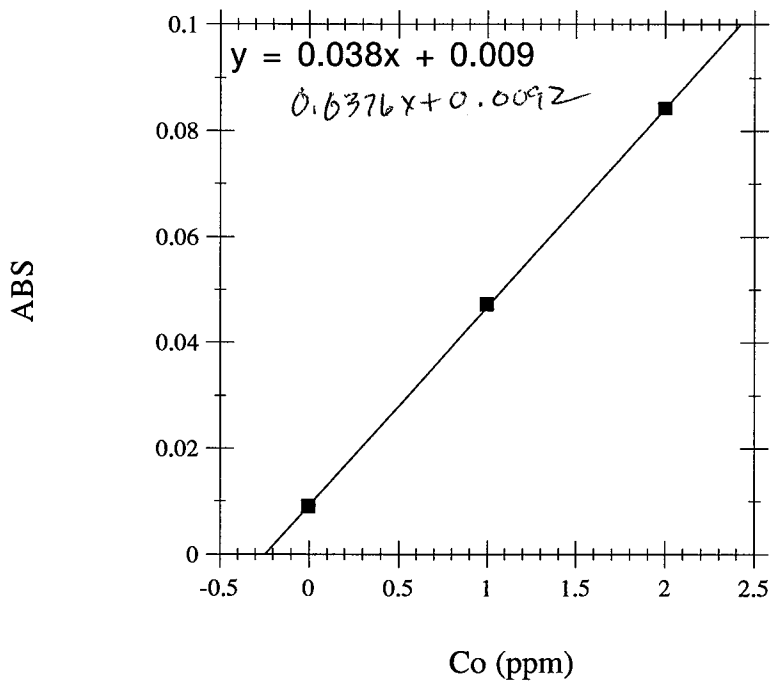
SAN-037 NaOAc



.1607 x 2 = .3214

$.3214 \times \frac{8}{1.021} = 2.518$ ppm

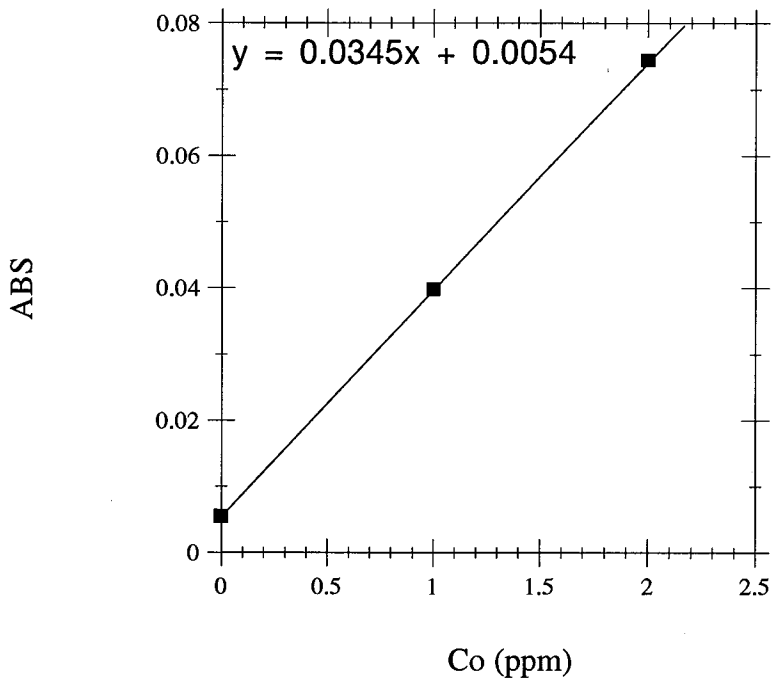
SAN-038 NaOAc



.2447 × 2 = .4894

$.4894 \times \frac{8}{1.024} = 3.823 ppm$

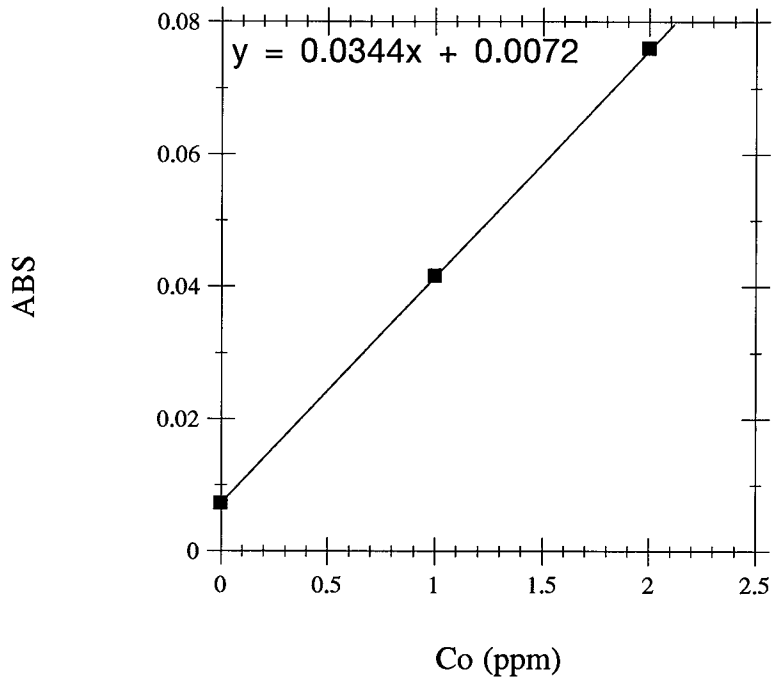
SAN-039 NaOAc



.1565 x 2 = .313

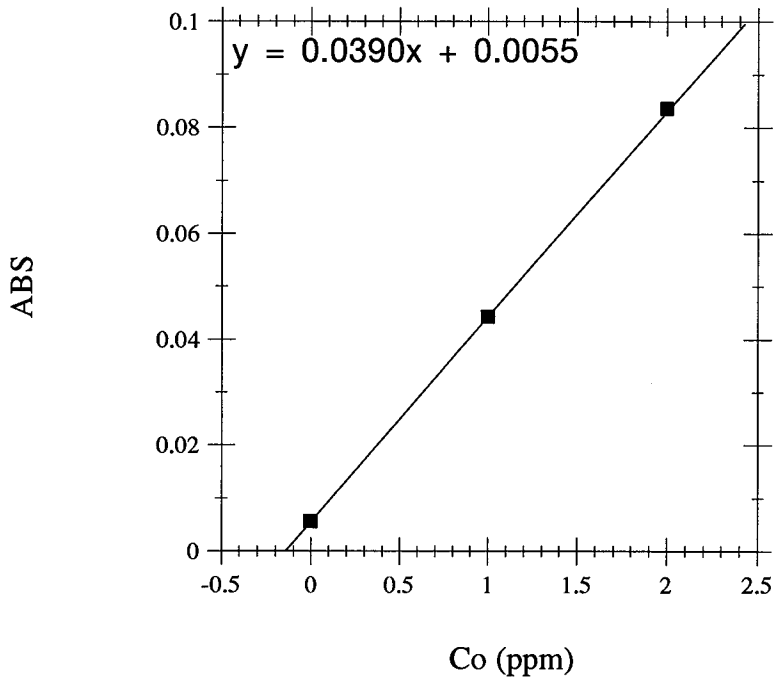
$.313 \times \frac{8}{1.018} = \underline{2.460 \text{ ppm}}$

SAN-040 NaOAc



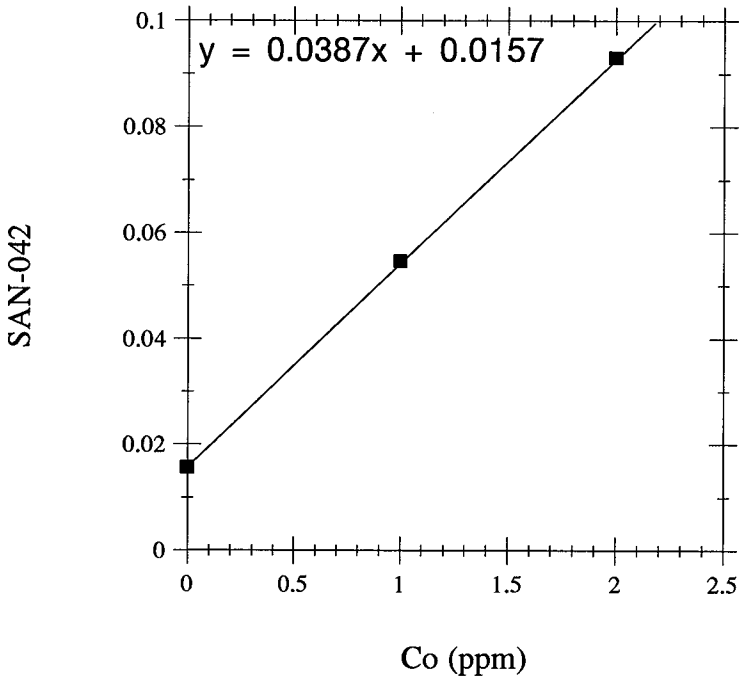
$.2093 \times 2 = .4186 \times \frac{8}{1.017} = 3.293\ ppm$

SAN-041 NaOAc



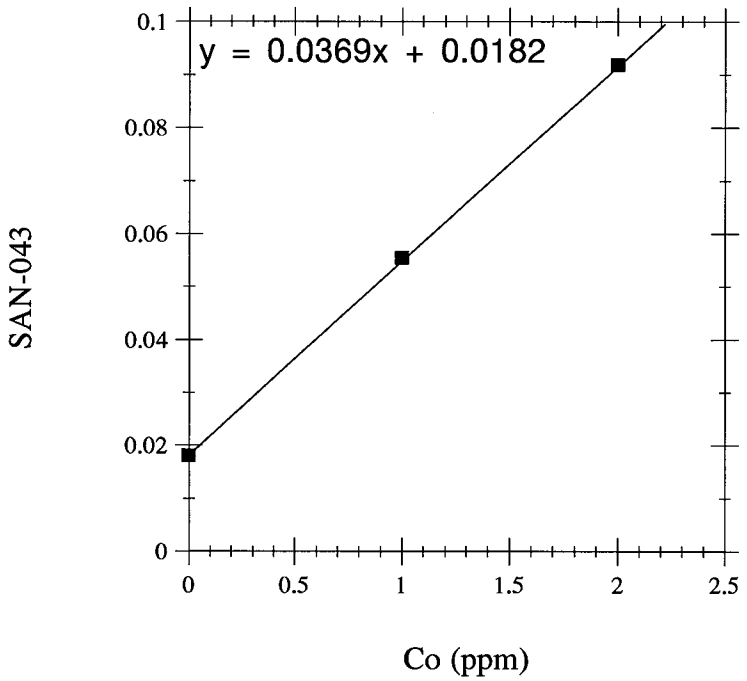
$.141 \times 2 = .282 \times \frac{8}{1.015} = \underline{2.223 \text{ ppm}}$

SAN-042 NaOAc



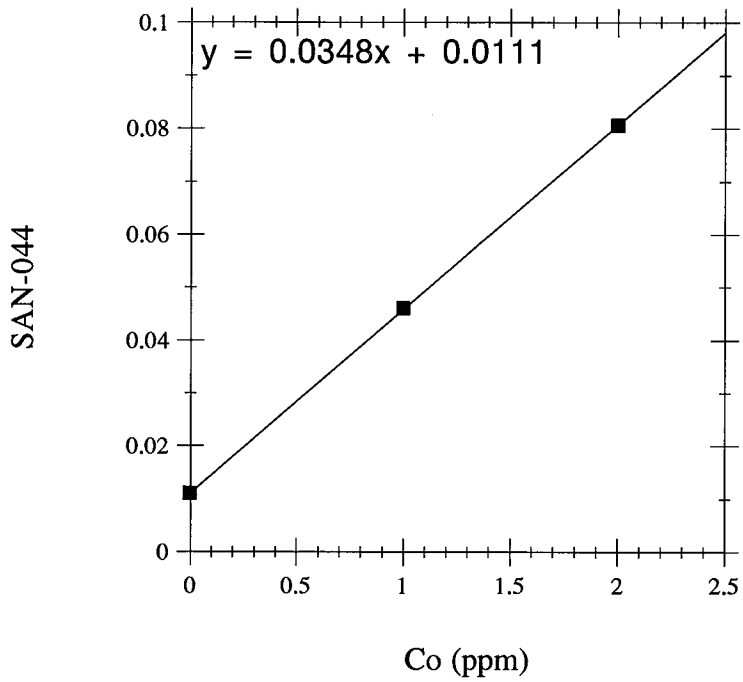
$.4057 \times 2 = .8114 \times \frac{8}{1.012} = 6.414$ ppm

SAN-043 NaOAc



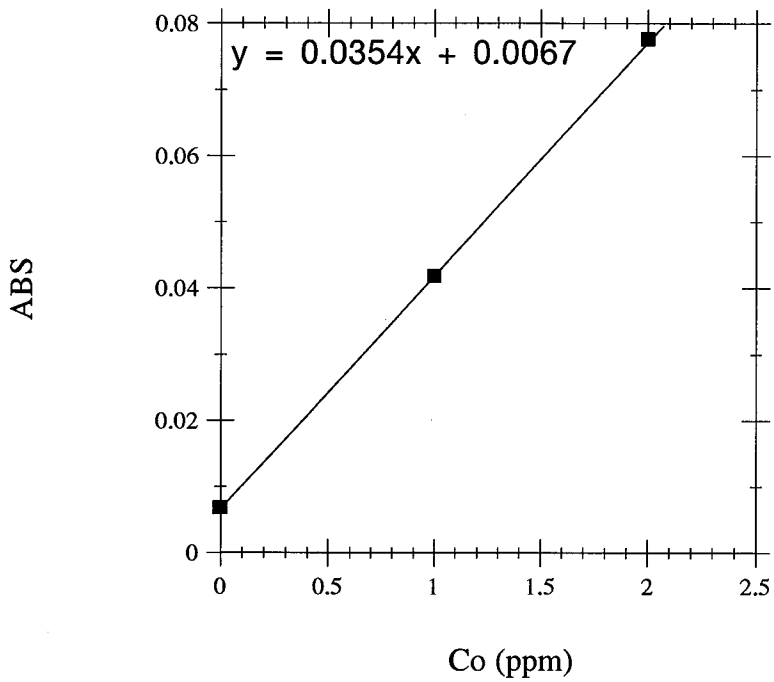
$.4932 \times 2 = .9864 \times \frac{8}{1.022} = 7.721 ppm$

SAN-044 NaOAc



~~.3189~~
.3190 x 2 = .638 x 8 / 1.014 = 5.033ppm

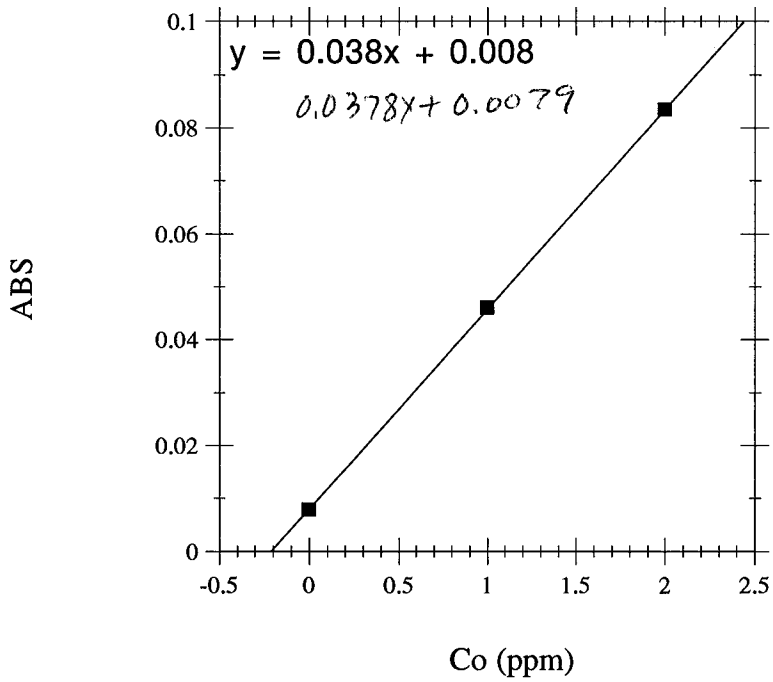
SAN-045 NaOAc



.1893 x 2 = .3786

$.3786 \times \frac{8}{1.017} = 2.978$ ppm

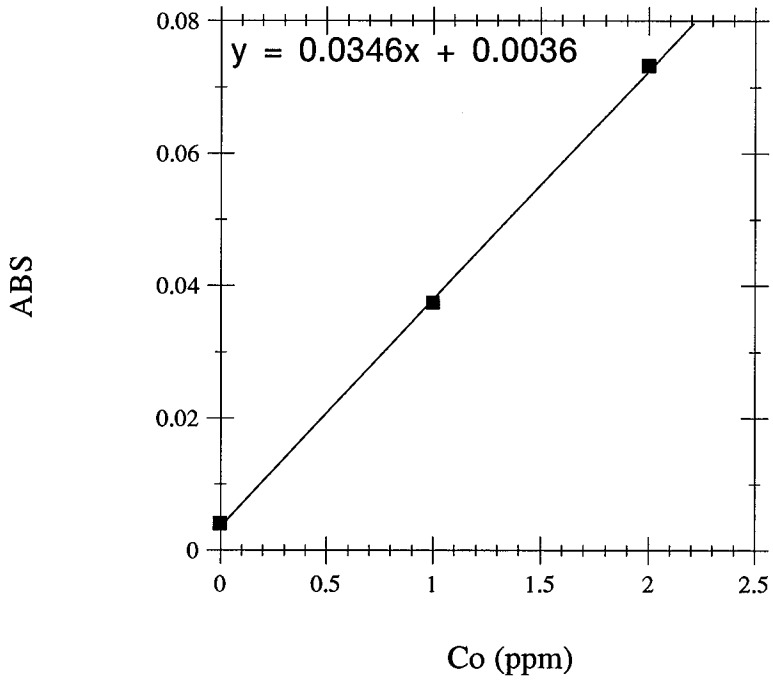
SAN-046 NaOAc



.209 x2 = .418

$.418 \times \frac{8}{1.022} = 3.272$ ppm

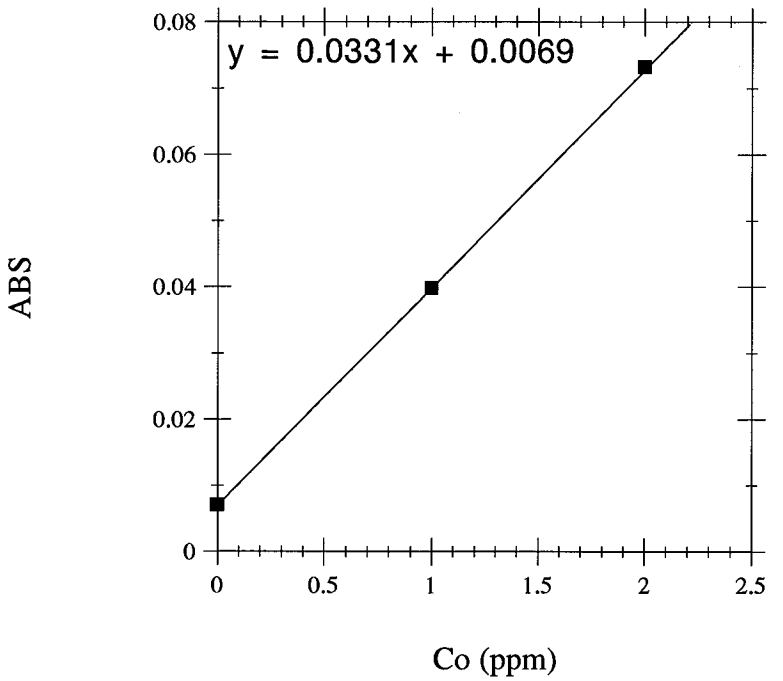
SAN-047 NaOAc



.1040 x 2 = .208

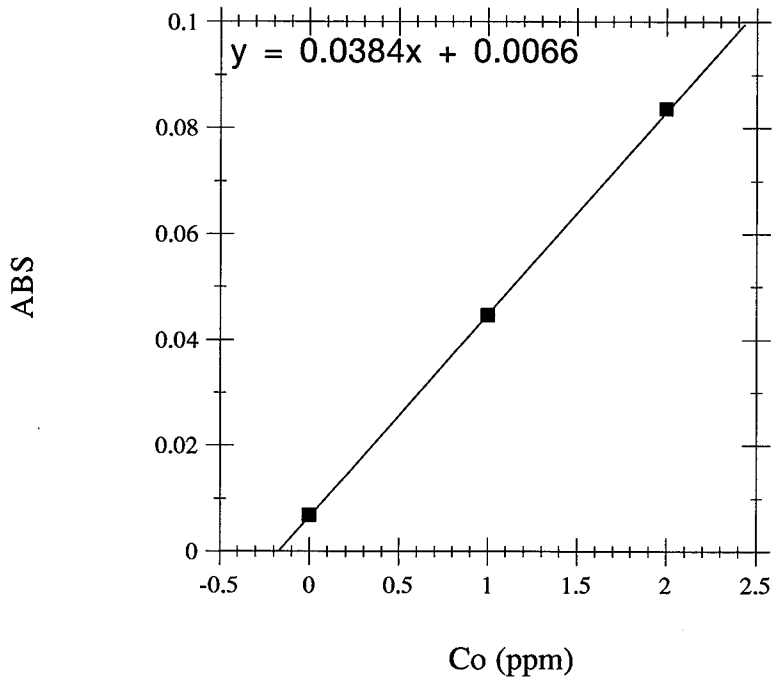
$\frac{.208 \times 8}{1.023} = .8136$ ppm

SAN-048 NaOAc

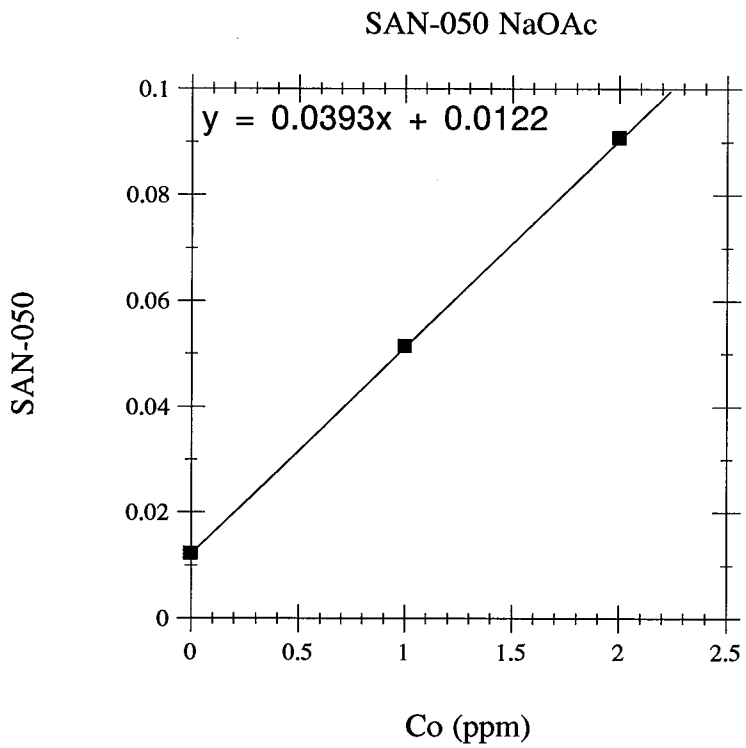


$.2085 \times 2 = \frac{.417 \times 8}{1.022} = 3.264$ ppm

SAN-049 NaOAc

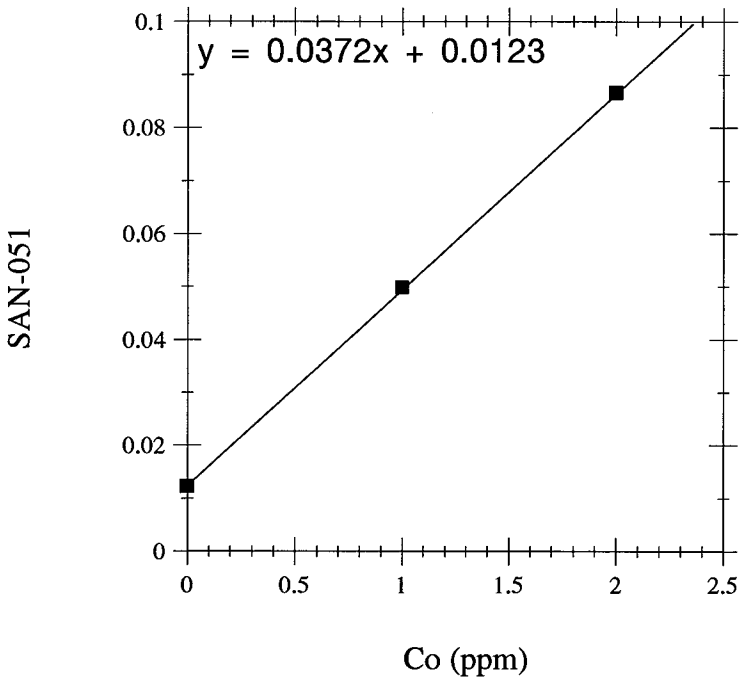


$.1719 \times 2 = .3438 \div \frac{8}{1.017} = 2.704$ ppm



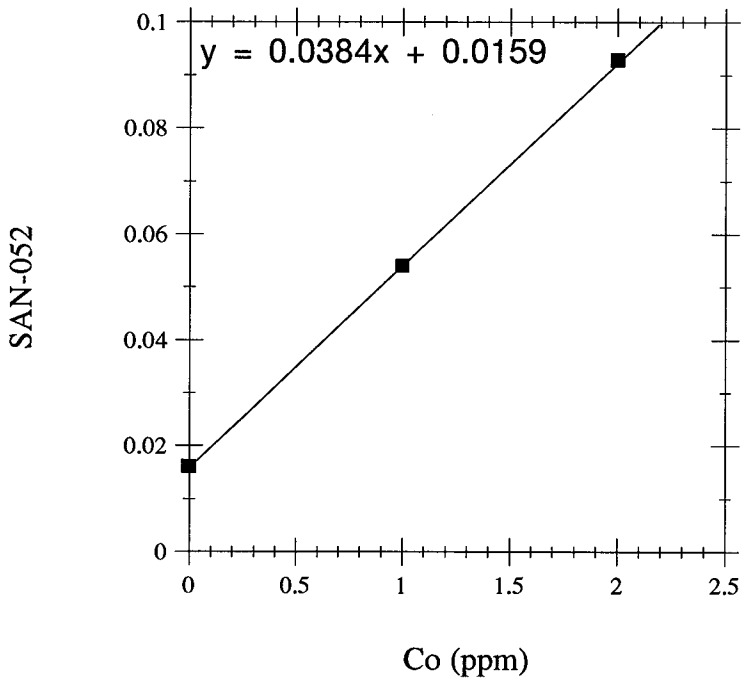
$.3104 \times 2 = .6208 \times \frac{8}{1.016} = 4.888$ ppm

SAN-051 NaOAc



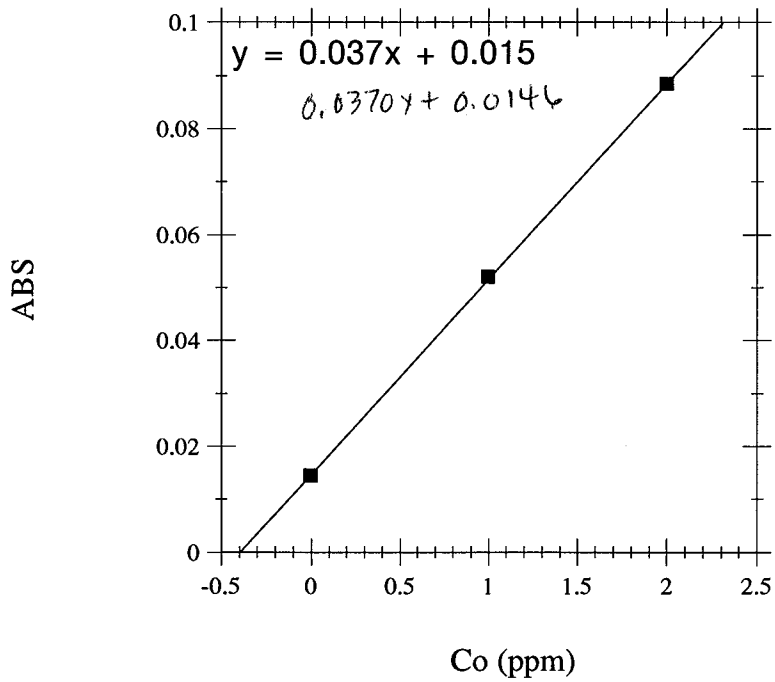
$.3306 \times 2 = .6612 \times \frac{8}{1.017} = 5.201$ ppm

SAN-052 NaOAc



$.4141 \times 2 = .8282 \times \frac{8}{1.02} = 6.496\,ppm$

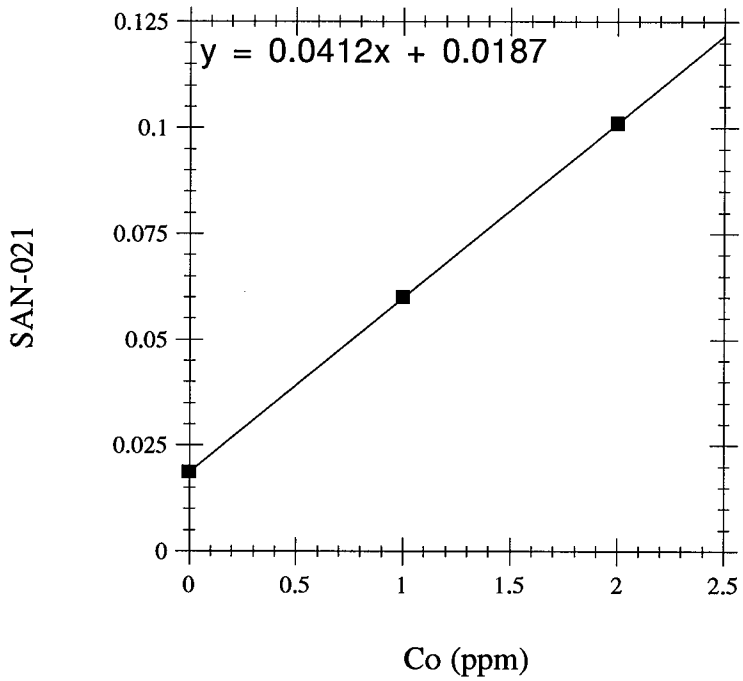
SAN-053 NaOAc



.3946 x 2 = .7892

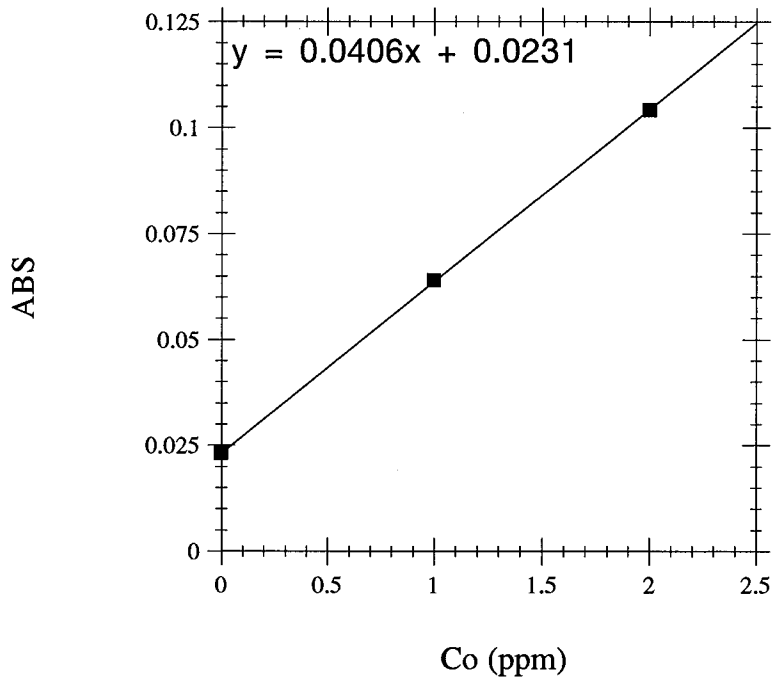
.7892 x 8/1.008 = 6.263 ppm

SAN-021 NH2OH



$.4539 \times 2 = .9078 \times \frac{8}{1.016} = 7.148$ ppm

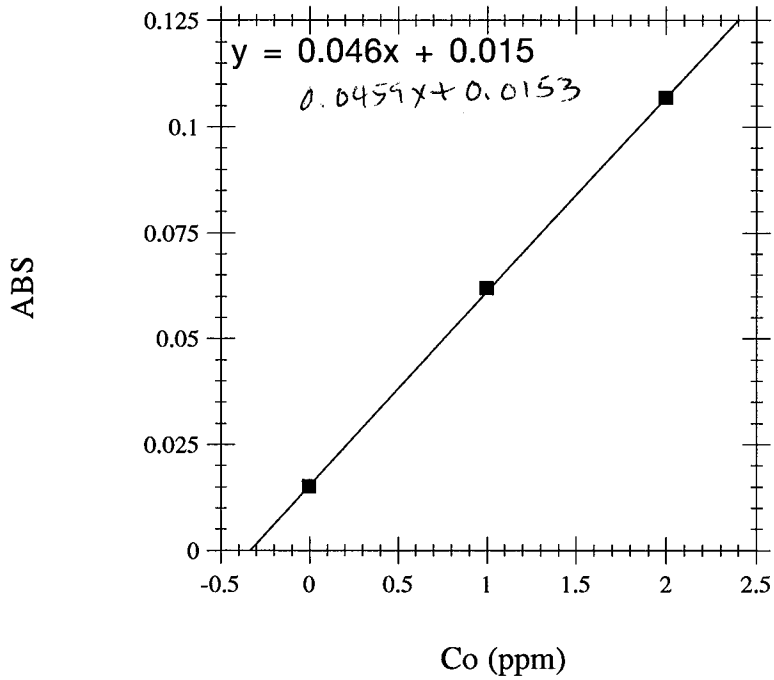
SAN-022 NH2OH



.5690 x 2 = 1.138

1.138 x 8 / 1.022 = 8.908 ppm

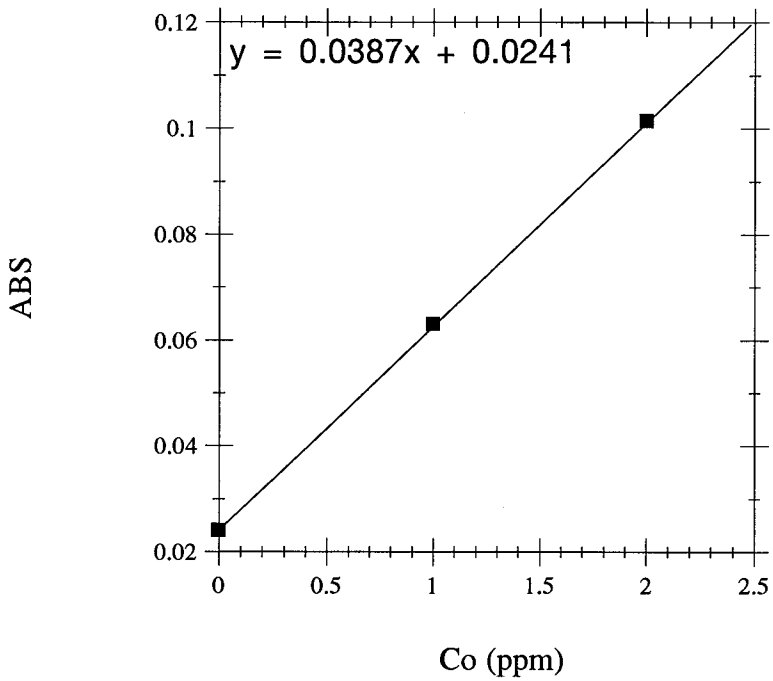
SAN-023 NH2OH



.3333 x 2 = .6666

.6666 x $\frac{8}{1.022}$ = 5.218 ppm

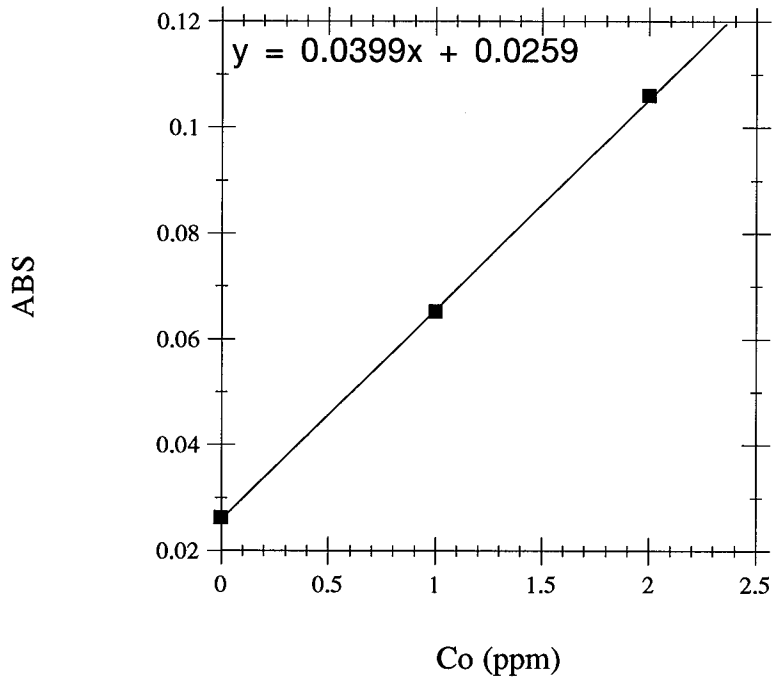
SAN-024 NH2OH



.6227 x 2 = 1.2454

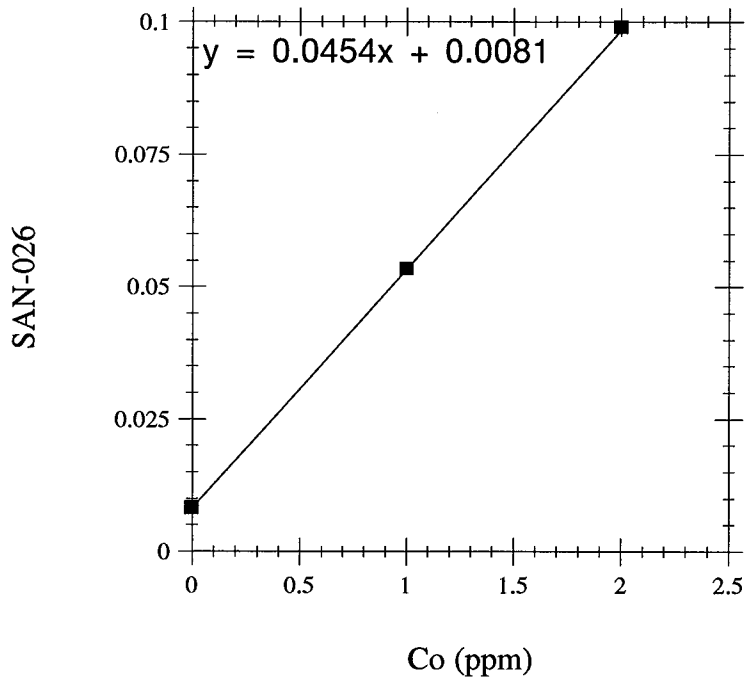
1.2454 x 8 / 1.018 = 9.787 ppm

SAN-025 NH2OH



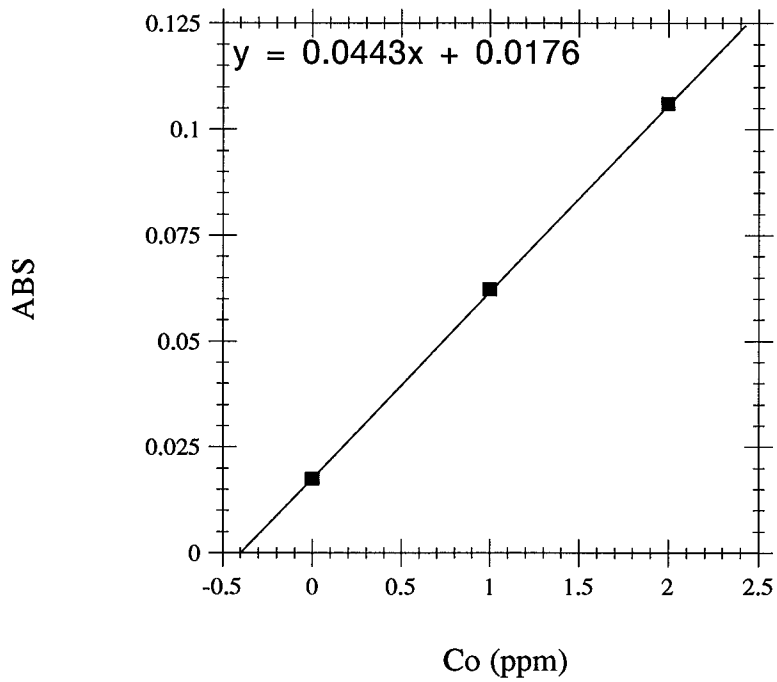
$.6491 \times 2 = 1.2982 \times \frac{8}{1.025} = 10.132$ ppm

SAN-026 NH2OH



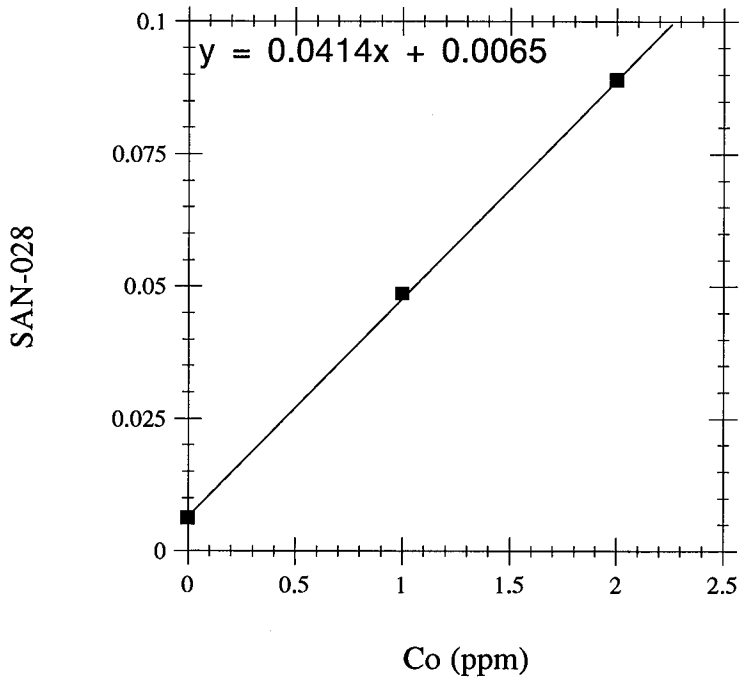
$.1784 \times 2 = .3568 \times \frac{8}{1.021} = 2.796$ ppm

SAN-027 NH2OH



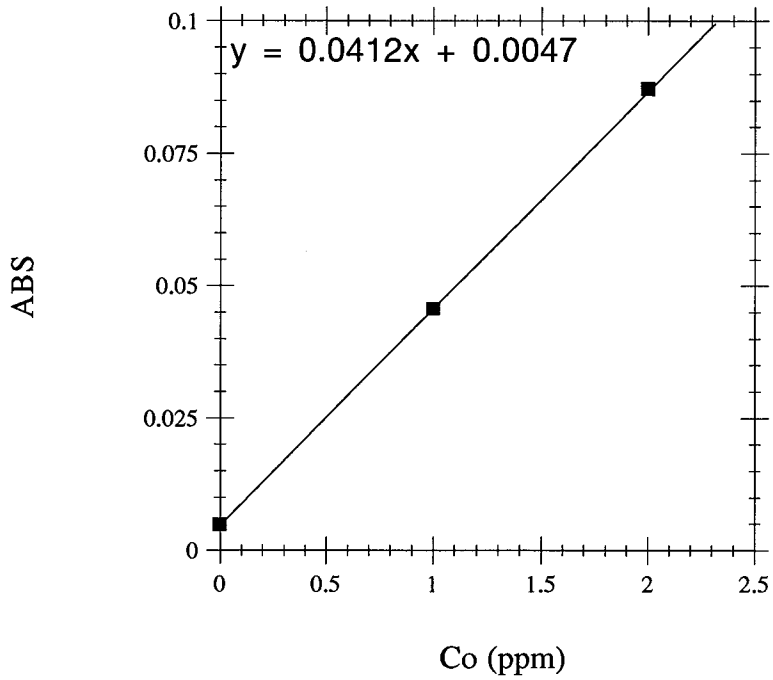
$.3973 \times 2 = .7946 \times \frac{8}{1.013} = 6.275$ ppm

SAN-028 NH2OH



$.157 \times 2 = .314 \times \frac{8}{1.023} = 2.455$ ppm

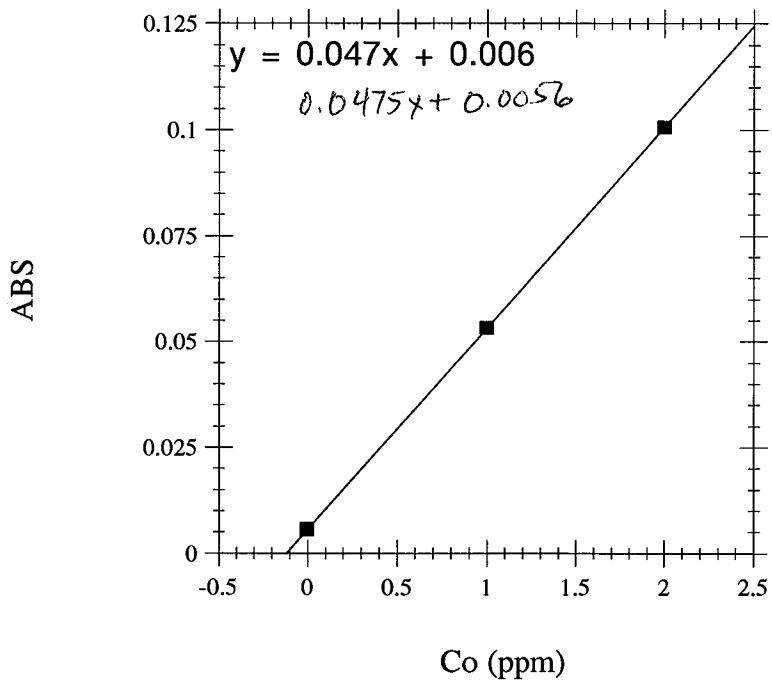
SAN-029 NH2OH



.1141 x 2 = .2282

$.2282 \times \frac{8}{1.02} = 1.790$ ppm

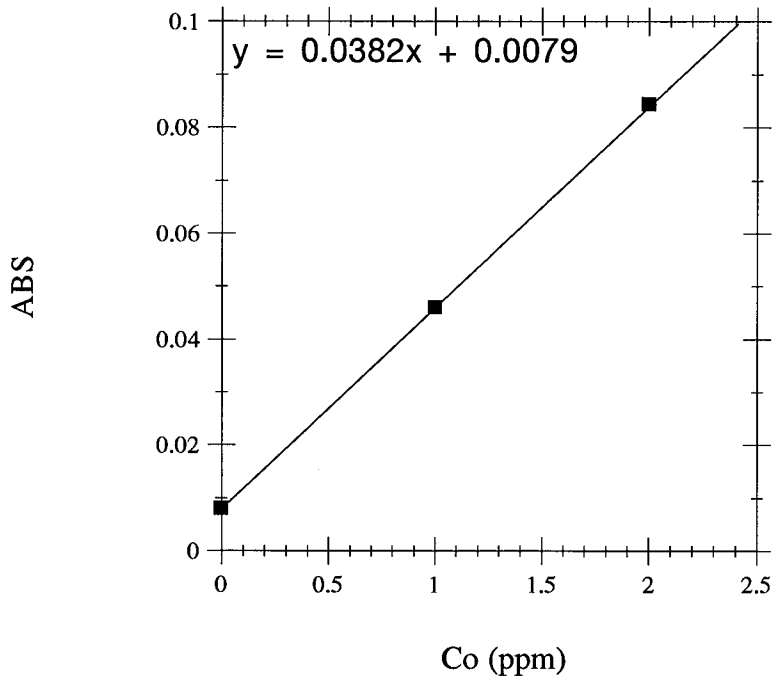
SAN-030 NH2OH



.1179 x 2 = .2358

$.2358 \times \frac{8}{1.022} =$ 1.846 ppm

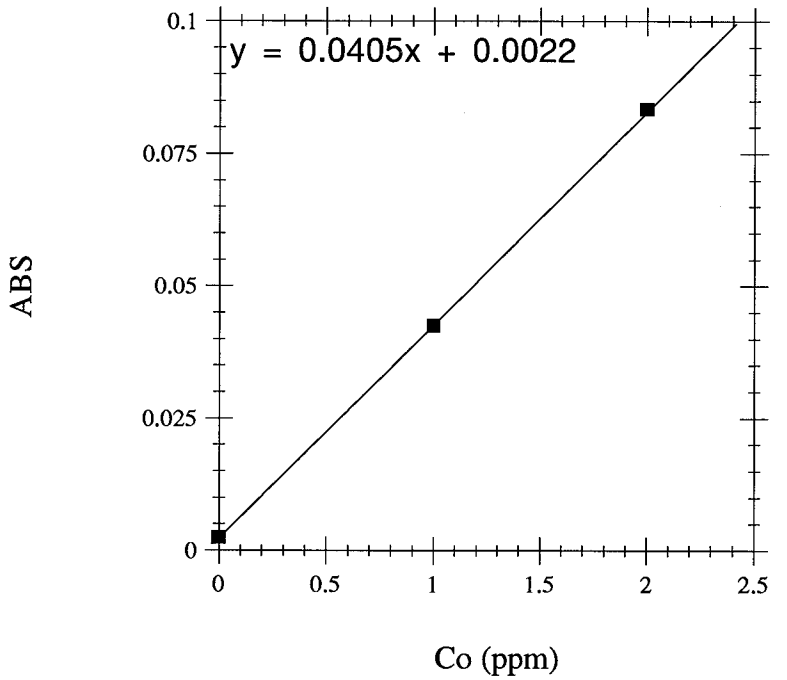
SAN-031 NH2OH



.2068 x 2 = .4136

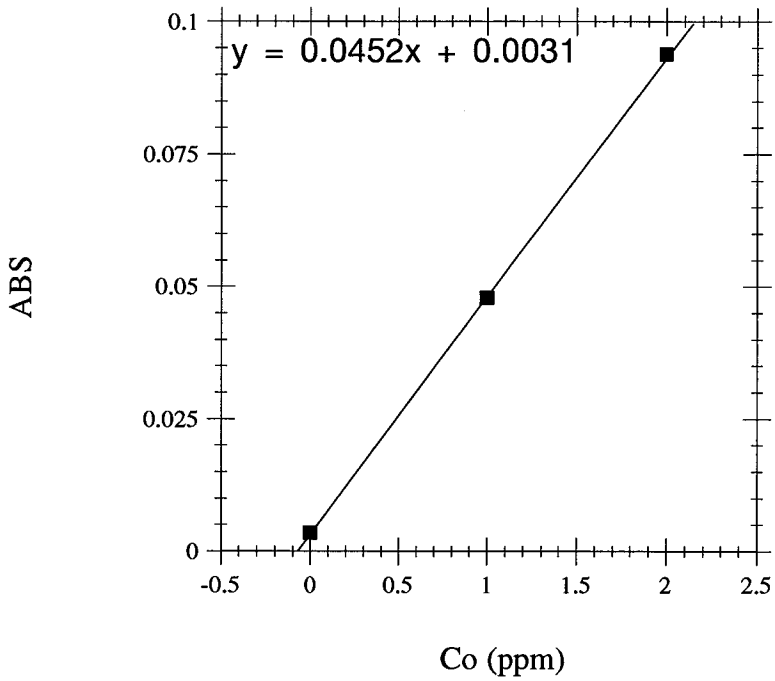
$.4136 \times \frac{8}{1.026} = 3.225 \text{ ppm}$

SAN-032 NH2OH



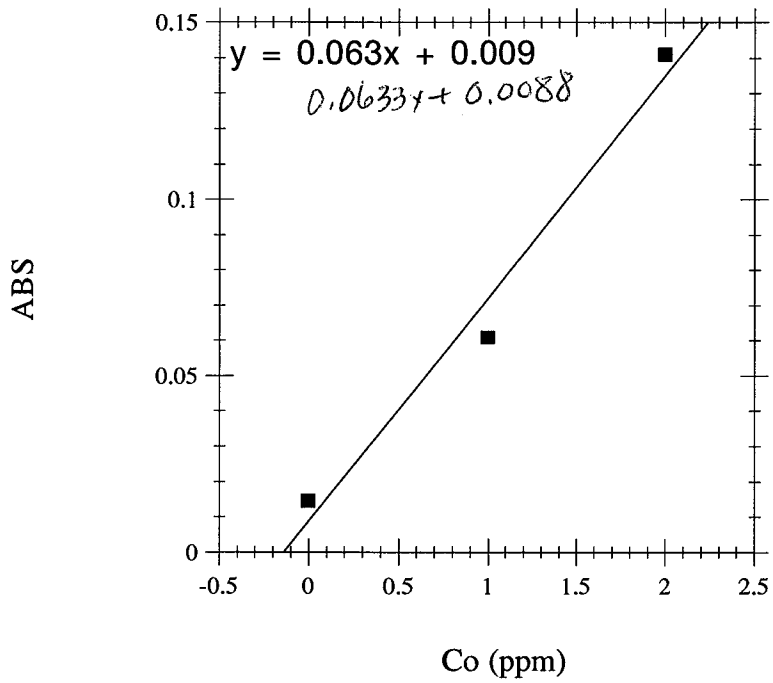
$.0543 \times 2 = .1086 \times \frac{8}{1.017} = .854$ ppm

SAN-033 NH2OH



.0686 x 2 = .1372 x 8/1.012 = 1.0840 ppm

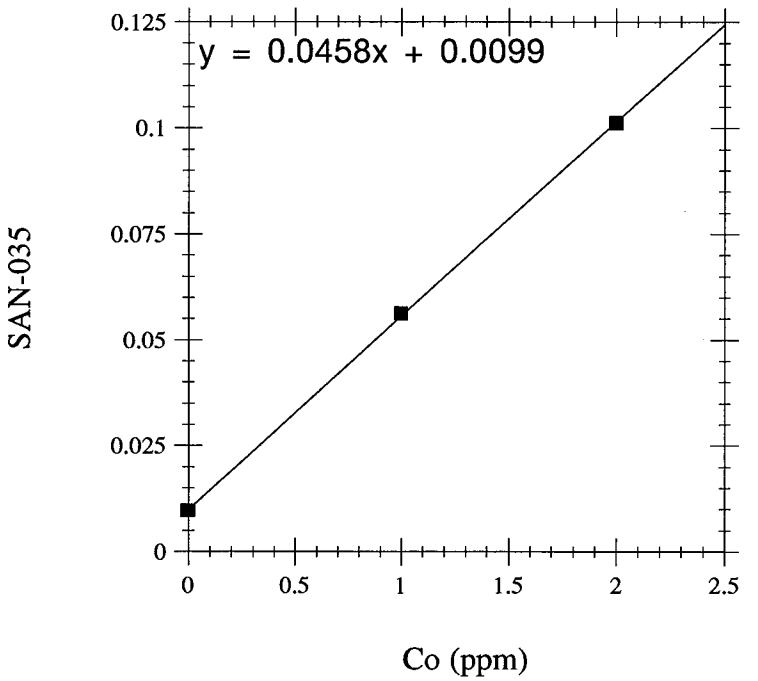
SAN-034 NH2OH



.139 x 2 = .278

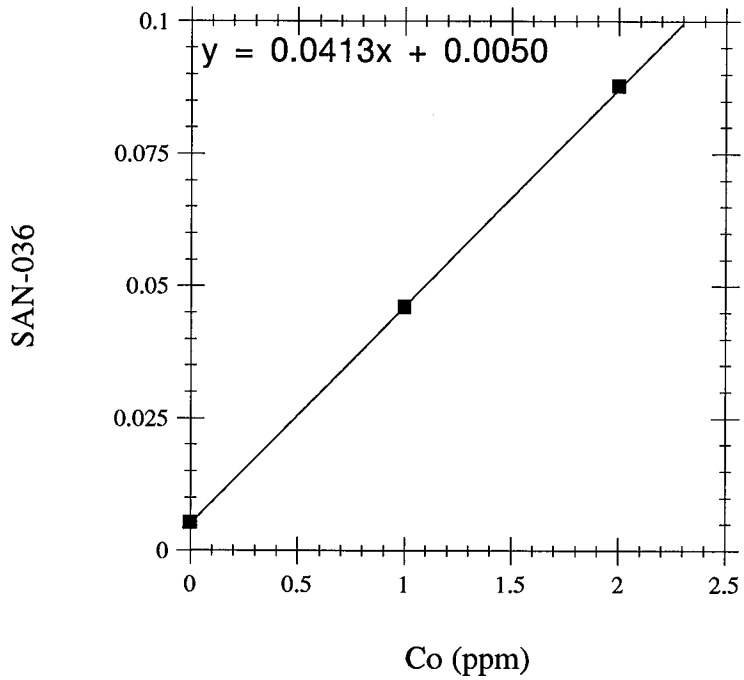
$.278 \times \frac{8}{1.009} = 2.204$ ppm

SAN-035 NH2OH



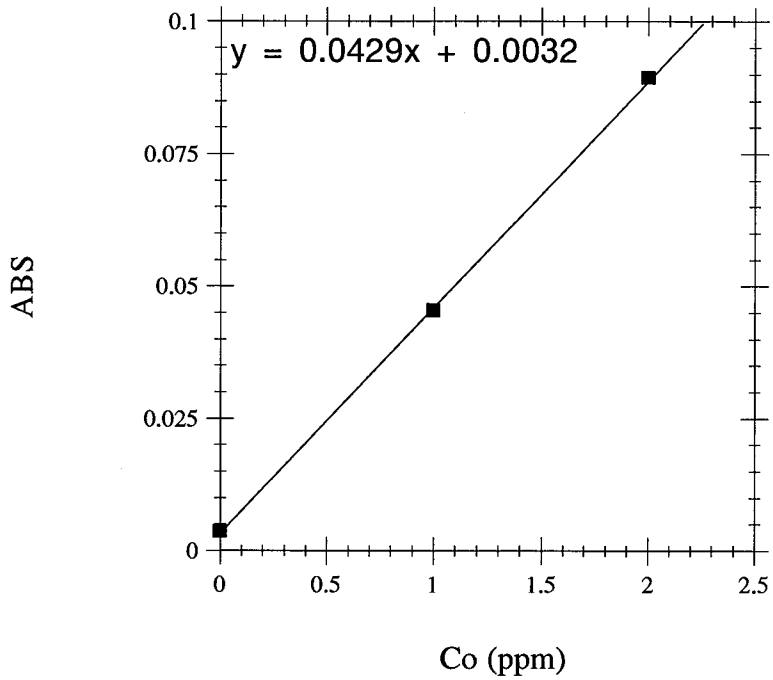
$.2162 \times 2 = .4324 \times \frac{8}{1.02} = 3.391$ ppm

SAN-036 NH2OH



$.1211 \times 2 = .2422 \times \frac{8}{1.014} = \underline{1.911 \text{ ppm}}$

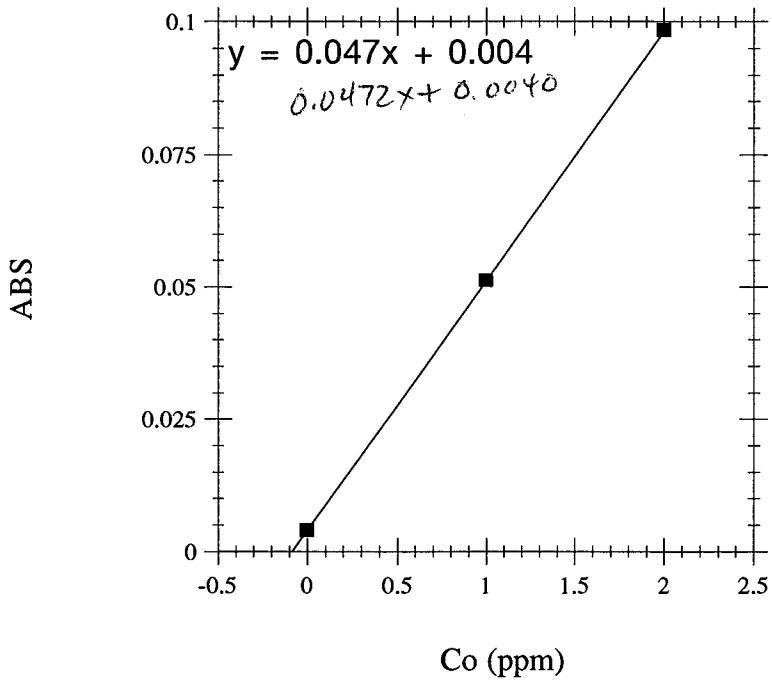
SAN-037 NH2OH



.0746 x 2 = .1492

$\frac{.1492 \times 8}{1.021} = 1.169$ ppm

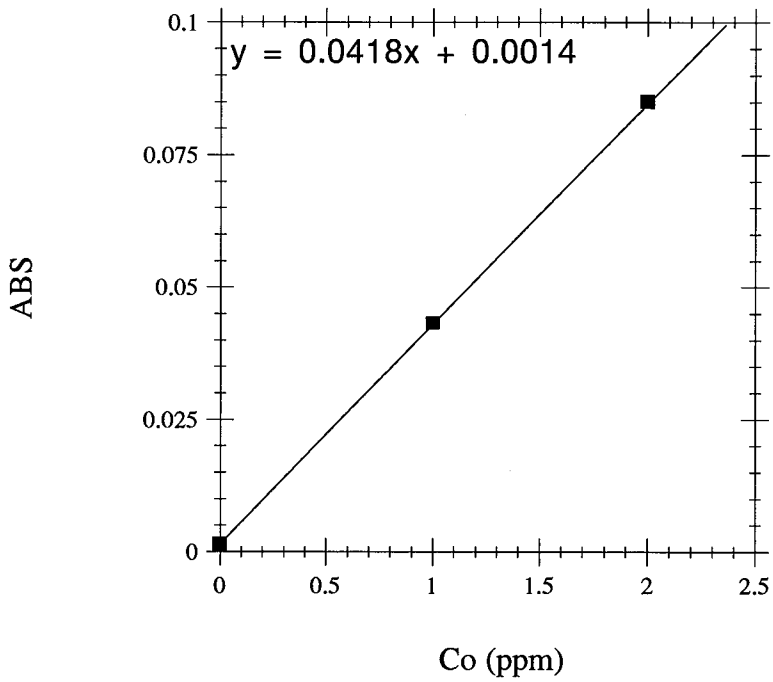
SAN-038 NH2OH



.0847 x 2 = .1694

.1694 x 8/1.024 = 1.323ppm

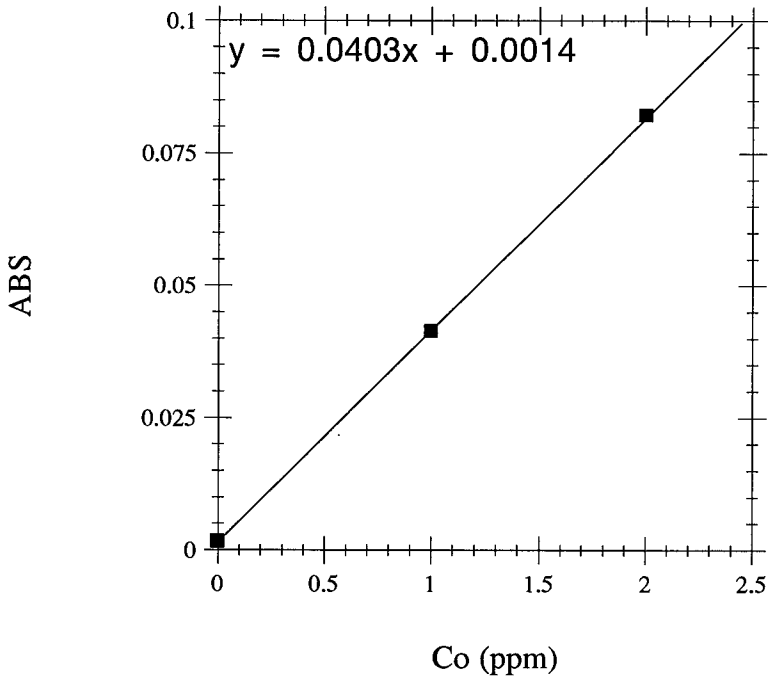
SAN-039 NH2OH



.0335 x 2 = .067

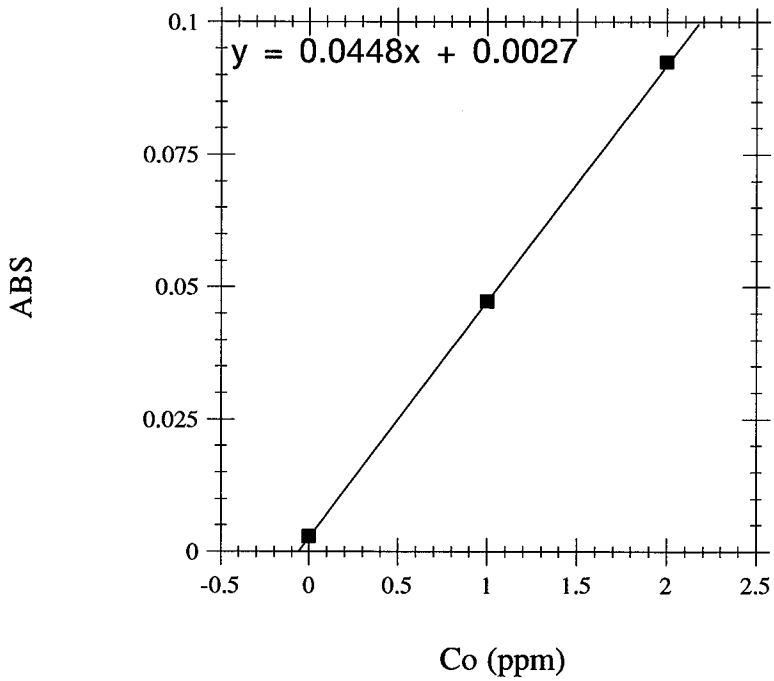
$.067 \times \frac{8}{1.018} = .526$ ppm

SAN-040 NH2OH



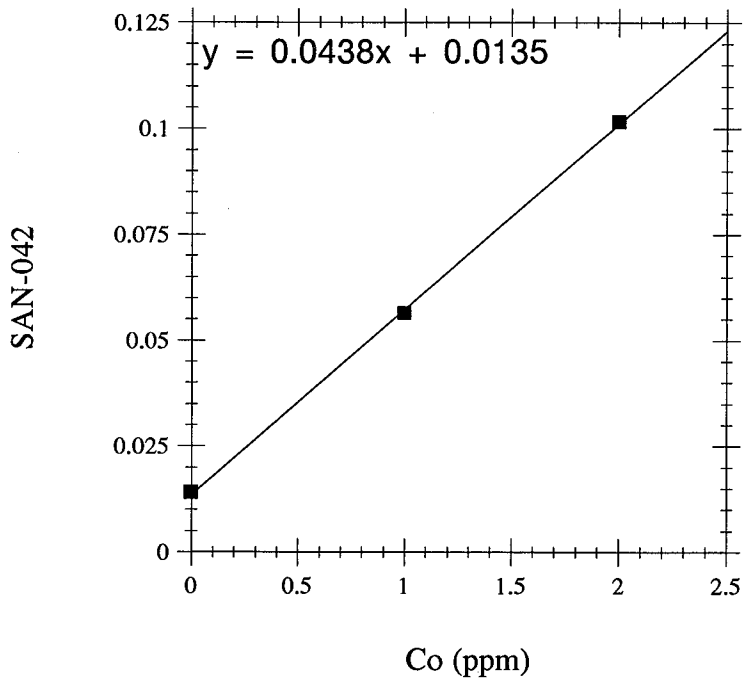
$.0347 \times 2 = .0694 \times \frac{8}{1.017} = .546$ ppm

SAN-041 NH2OH



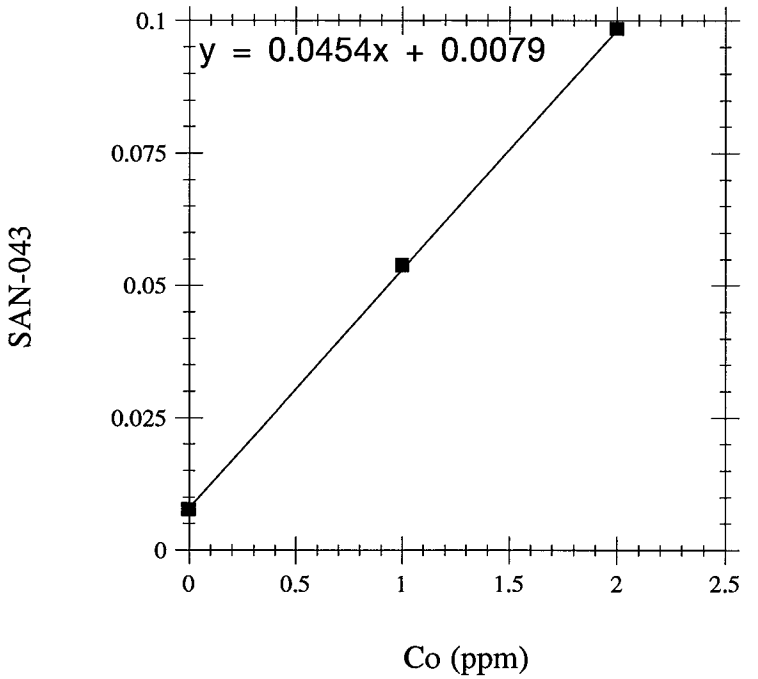
.0603 x 2 = .1206 x 8 / 1.015 = .950 ppm

SAN-042 NH2OH



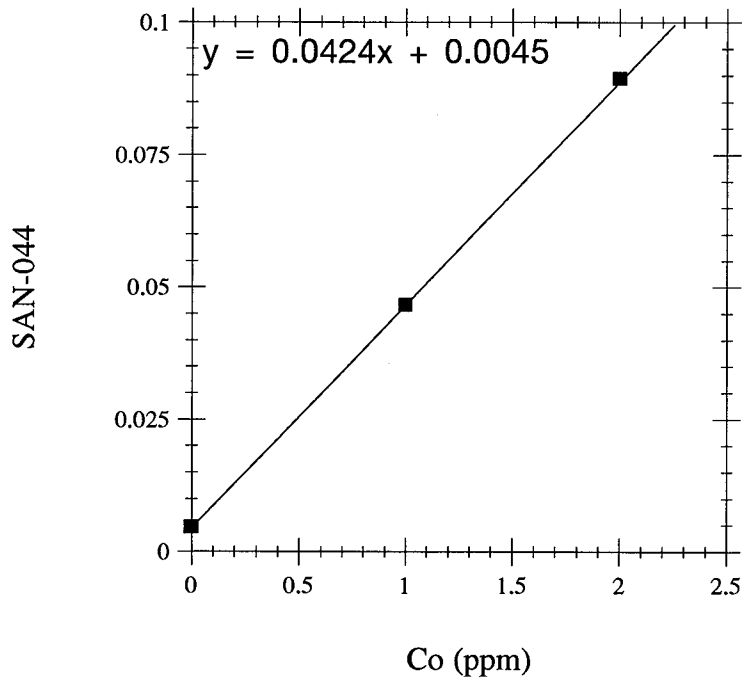
$.3082 \times 2 = .6164 \times \frac{8}{1.012} = 4.873\,ppm$

SAN-043 NH2OH



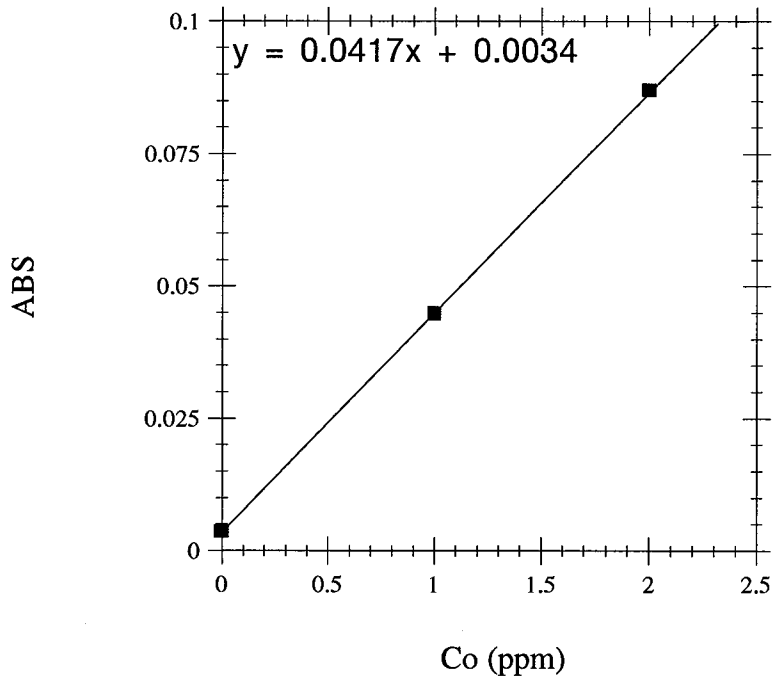
$.174 \times 2 = .348 \times \frac{8}{1.022} = 2.724 \text{ ppm}$

SAN-044 NH2OH



$.1061 \times 2 = .2122 + \frac{.8}{1.014} = \underline{1.674 \text{ ppm}}$

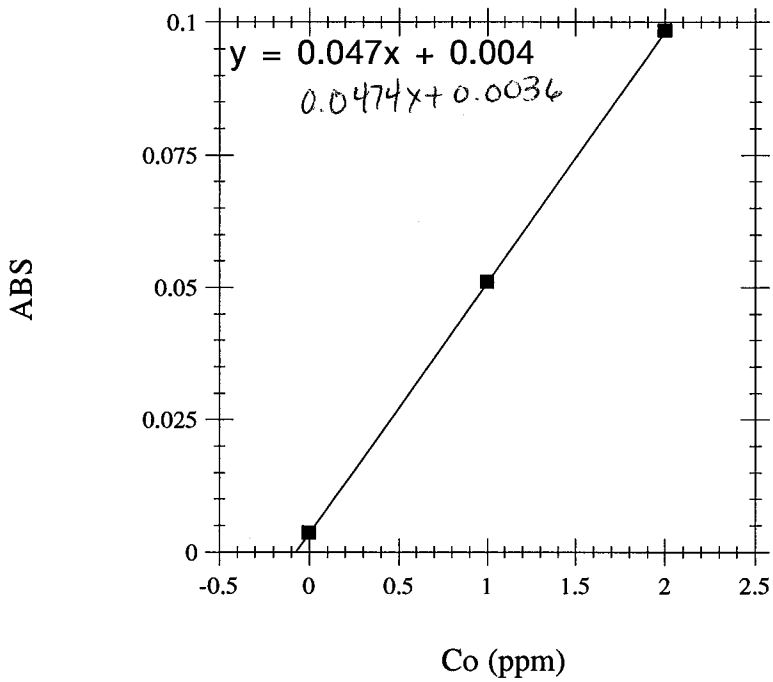
SAN-045 NH2OH



.0815 x 2 = .163

$\frac{.163 \times 8}{1.017} = 1.282$ ppm

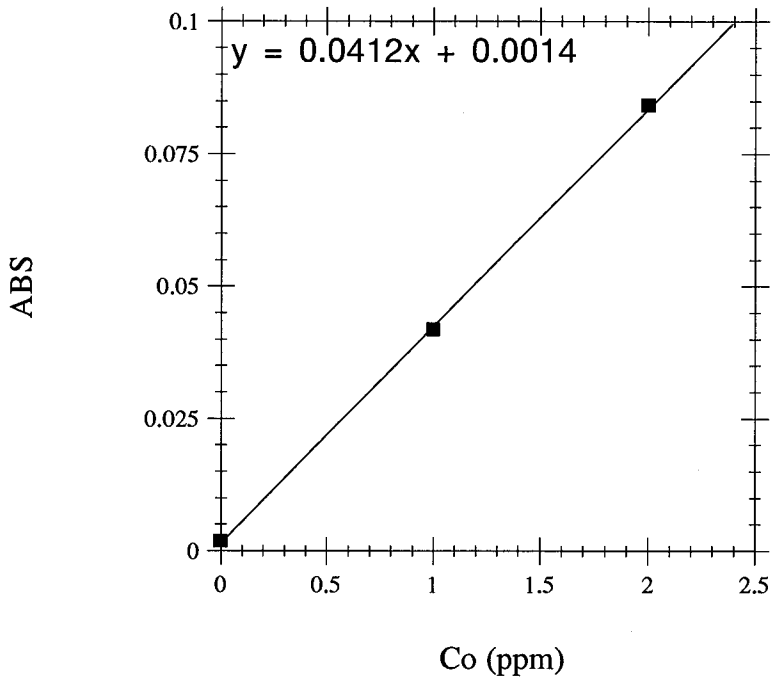
SAN-046 NH2OH



.07559 x 2 = ~~.1519~~ .1518

.1518 x 8/1.022 = 1.188 ppm

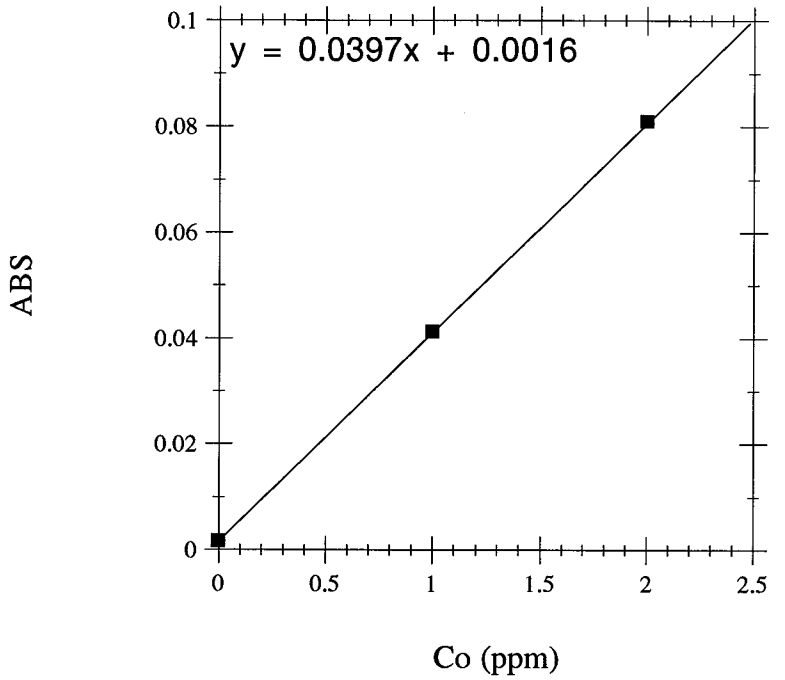
SAN-047 NH2OH



~~.033~~ .034 x 2 = .068

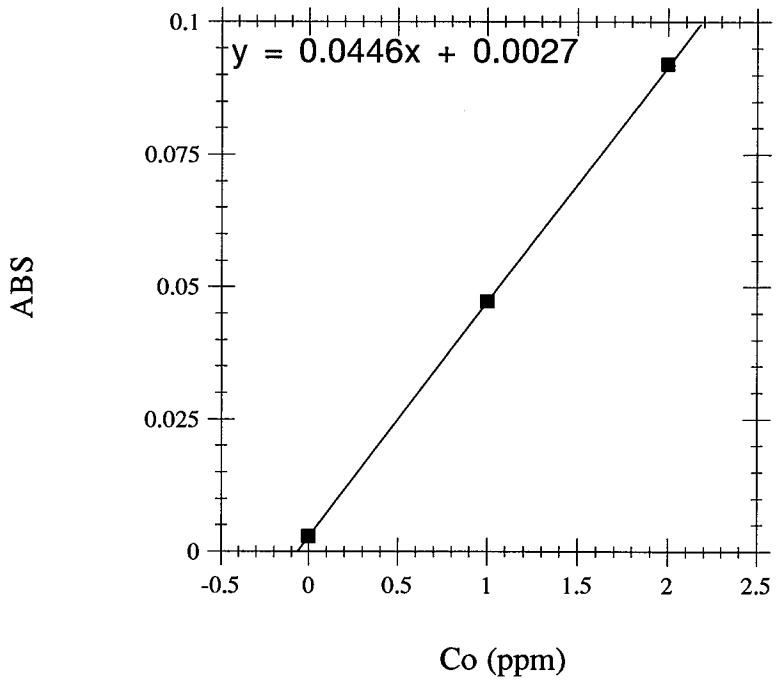
$.068 \times \frac{8}{1.023} = .532$ ppm

SAN-048 NH2OH



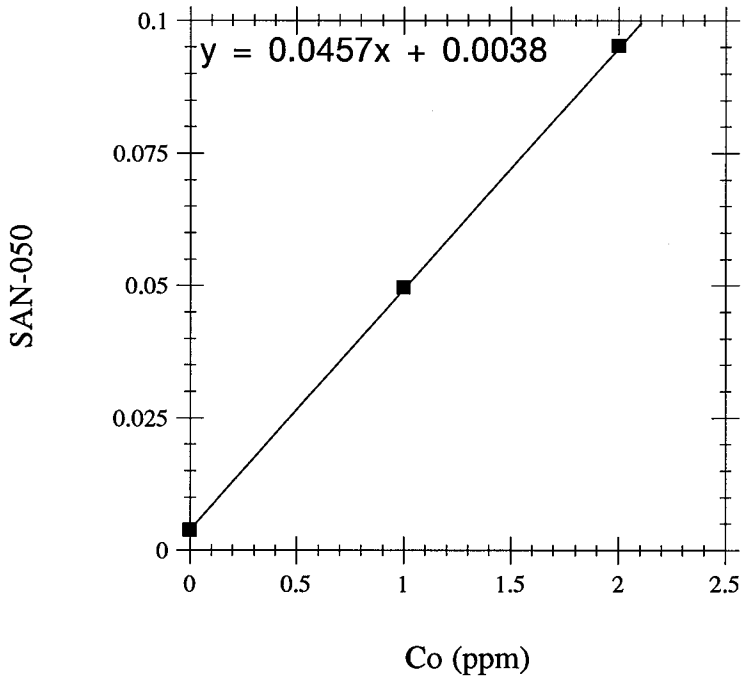
$.0403 \times 2 = .0806 \times \frac{8}{1.022} = .631$ ppm

SAN-049 NH2OH



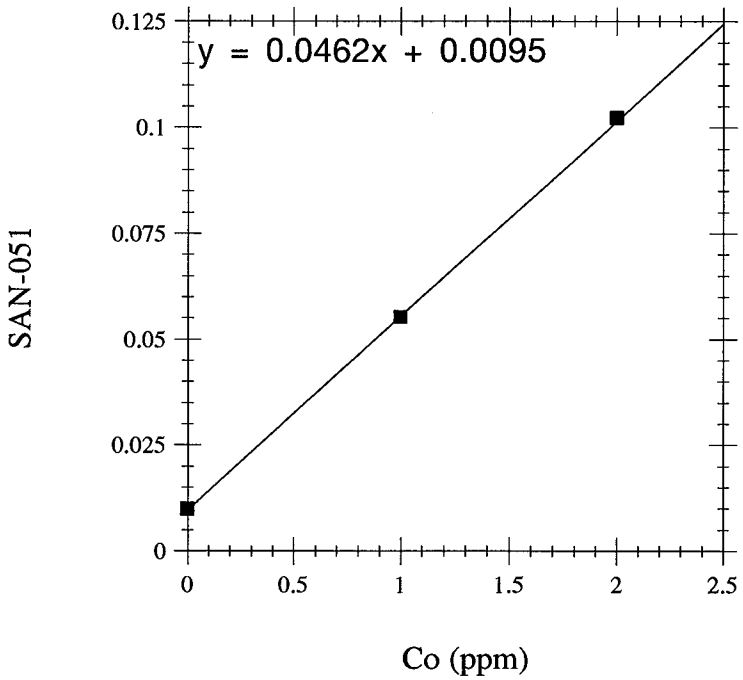
.0605 x 2 = .1210 x 8/1.017 = .952 ppm

SAN-050 NH2OH



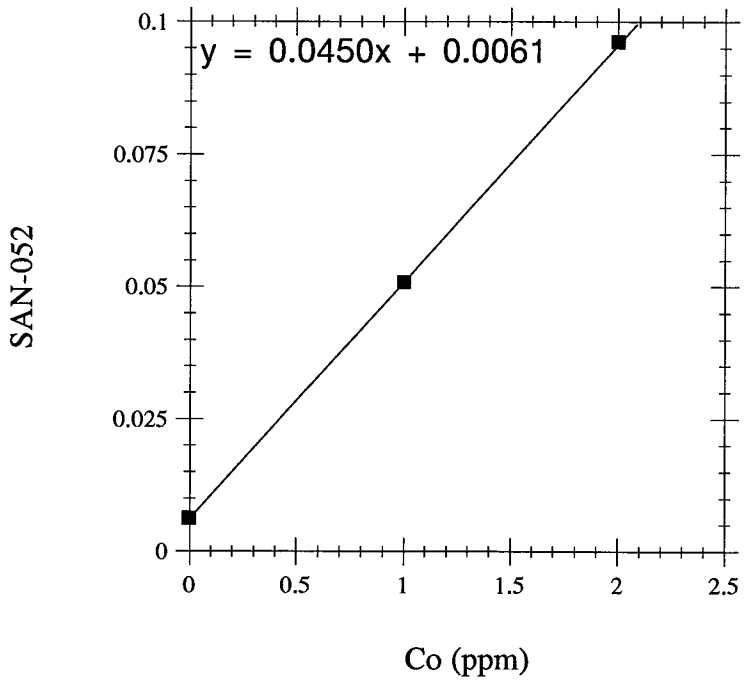
$.0831 \times 2 = .1662 \times \frac{8}{1.016} = 1.3087 \text{ ppm}$

SAN-051 NH2OH



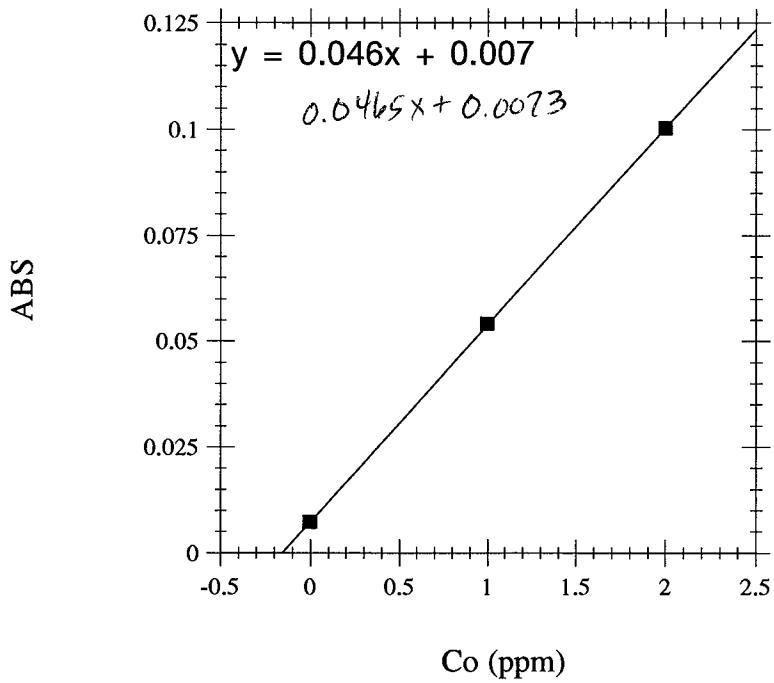
$.2056 \times 2 = .4112 \times \frac{8}{1.017} = 3.235$ ppm

SAN-052 NH2OH



$.1355 \times 2 = .271 \times \frac{8}{1.02} = 2.125$ ppm

SAN-053 NH2OH

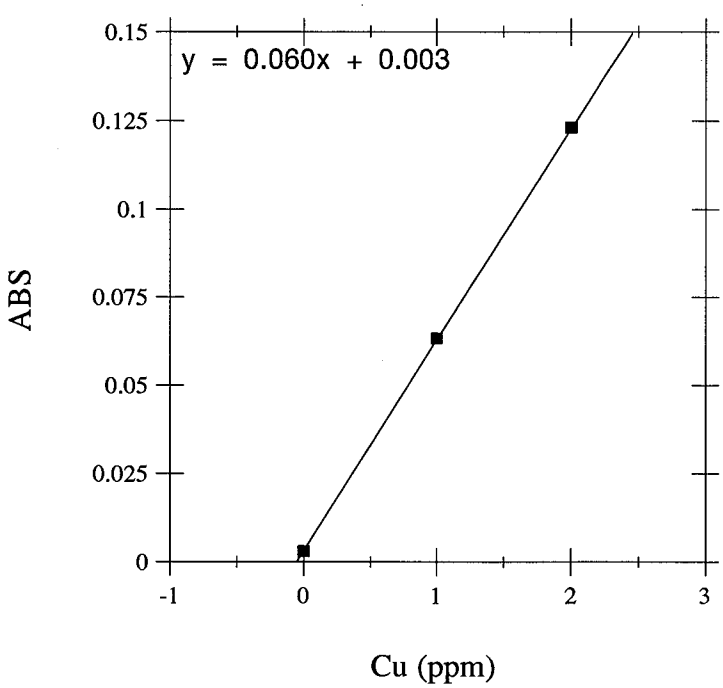


.1569 x 2 = .3138

.3138 x 8/1.008 = 2.490 ppm

	SAN023 MgCl	SAN030 MgCl	SAN023 NaOAC	SAN030 NaOAc	SAN023 NH_2OH	SAN-030 NH_2OH
Pb A	.006 .005 .004 .004 .004	.005 .004 .004 .005 .004	.003 .004 .004 .003 .004	.004 .004 .005 .005 .004	.001 .000 .000 .000 .001	.002 .001 .000 .000 .000
Zn	.006 .007 .007 .007 .007	.006 .006 .007 .007 .006	.017 .016 .015 .016 .016	.028 .027 .028 .028 .028	.111 .111 .110 .109 .110	.039 .040 .040 .040 .040
B	.027 .027 .028 .028 .028 .146 .144 .147 .146 .145	.028 .027 .027 .028 .028 .131 .130 .132 .130 .131	.029 .028 .029 .028 .028 .148 .147 .147 .147 .145	.028 .028 .028 .029 .029 .159 .159 .158 .157 .161	.028 .027 .028 .027 .027 .256 .251 .256 .254 .255	.030 .029 .029 .028 .029 .191 .190 .192 .192 .190
C	.051 .051 .050 .051 .050 .265 .263 .265 .258 .257	.053 .053 .053 .054 .053 .259 .255 .253 .254 .254	.054 .054 .053 .054 .053 .271 .275 .275 .273 .277	.053 .054 .053 .053 .052 .290 .287 .291 .289 .288	.055 .055 .056 .054 .055 .394 .398 .395 .396 .395	.057 .057 .056 .056 .057 .333 .335 .333 .336 .335

SAN-023 $MgCl_2$



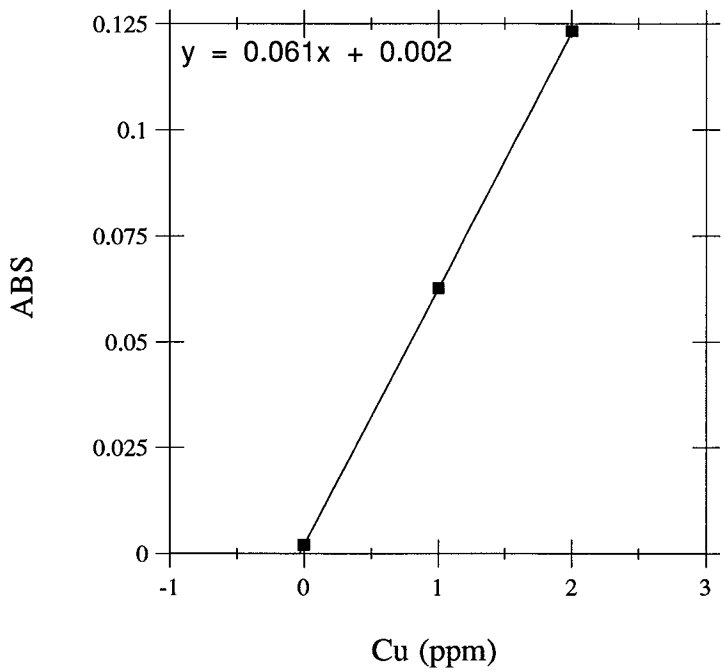
.05 ppm

X2 = .10 ppm

.10ppm $\frac{8\text{ g soln}}{1.019\text{ g solid}}$ =

0.785 ppm

SAN-030 $MgCl_2$



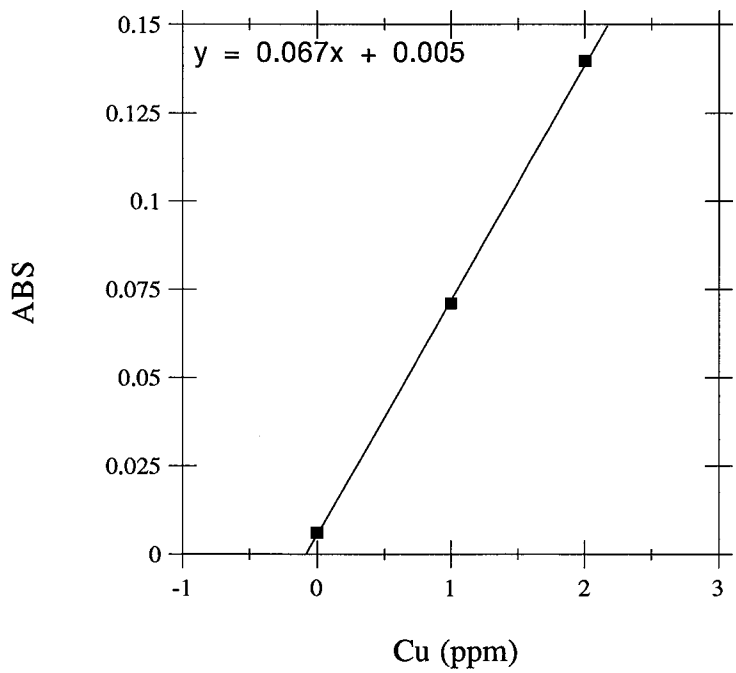
.033 ppm

x2 = .066

.066 ~~3mg~~ soln / 1.023g solid

0.516 ppm

SAN-023 NaOAc



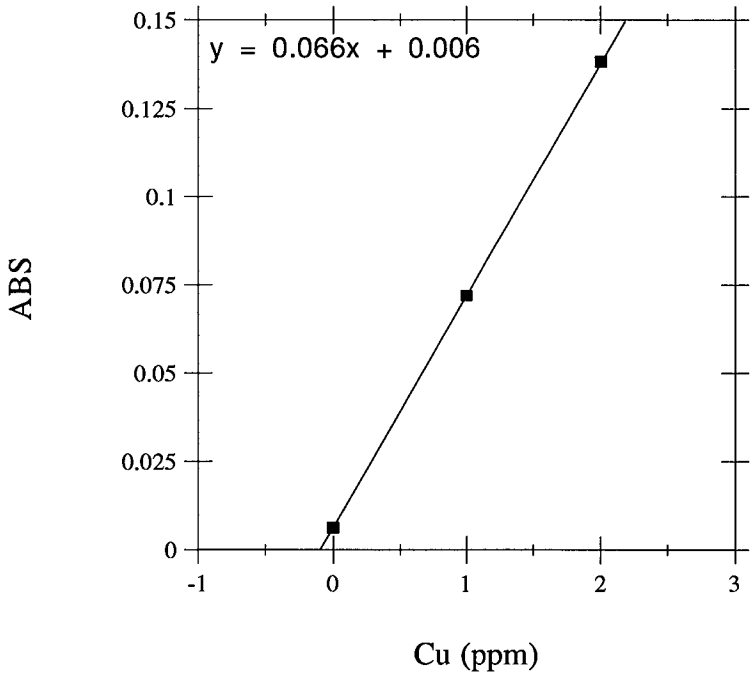
.075 ppm

x2 = .15 ppm

$.15 \text{ ppm} \times \frac{8 \text{ g soln}}{1.019 \text{ g solid}} =$

1.178 ppm

SAN-030 NaOAc



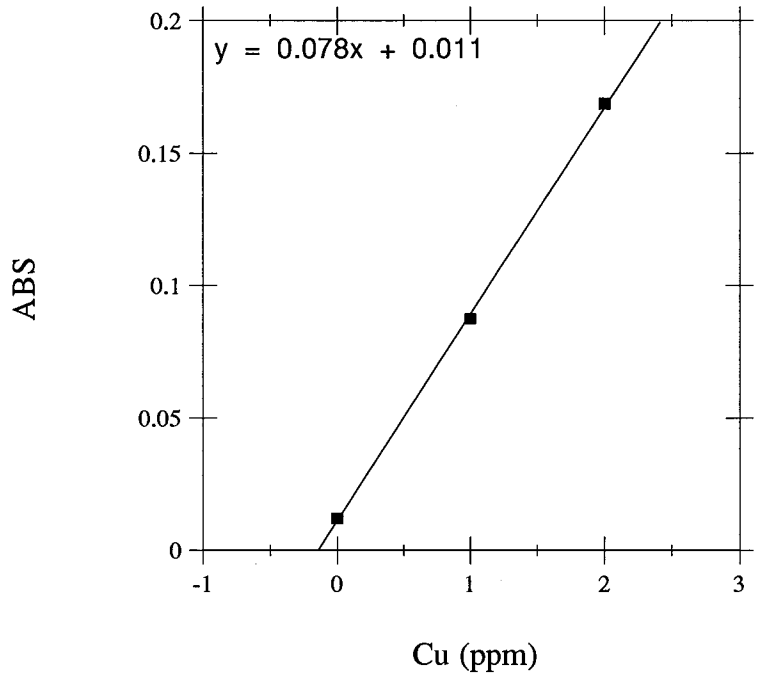
.091 ppm

×2 = .182 ppm

$.182 \times \frac{8\ g\ soln}{1.023\ g\ solid} =$

1.423 ppm

SAN-023 NH_2OH



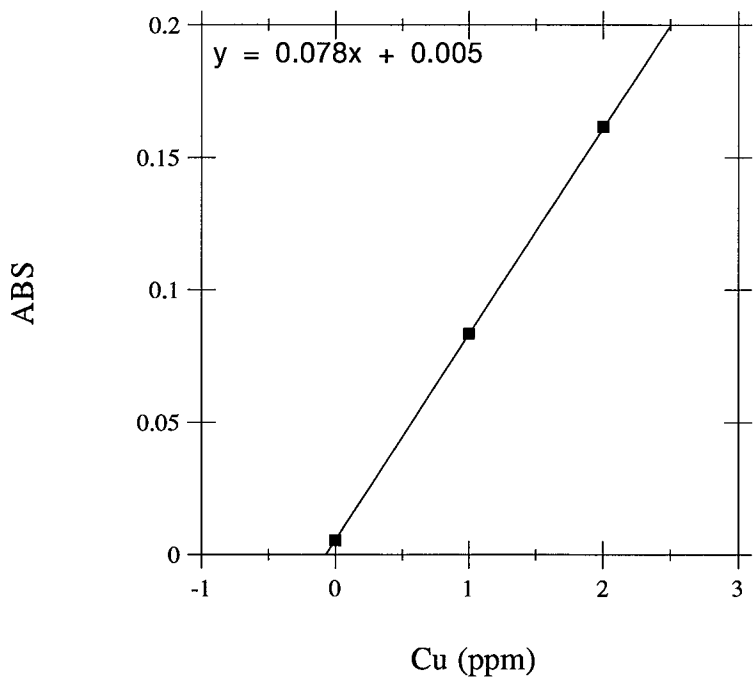
0.141 ppm

×2 = .282 ppm

$.282 \times \frac{8\ \text{solw}}{1.019\ \text{g solid}} =$

2.214 ppm

SAN-030 NH_2OH



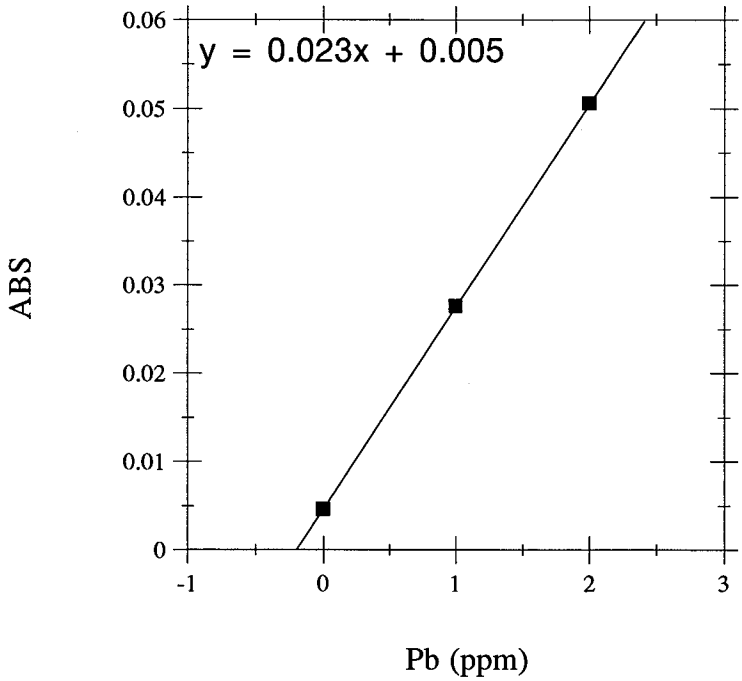
.064 ppm

x2 = .128 ppm

$.128 \times \frac{8\ g\ soln}{1.023\ g\ soln} =$

1.00 ppm

SAN-023 $MgCl_2$



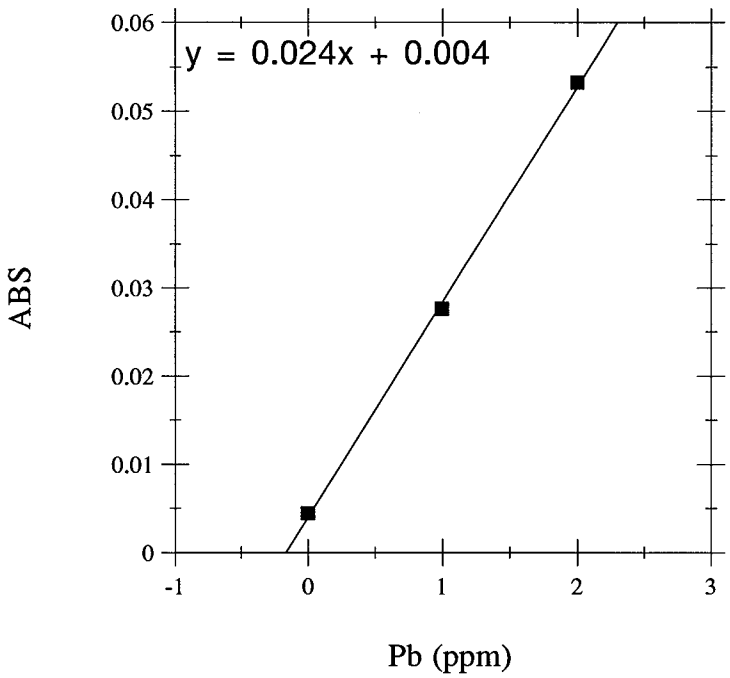
.217 ppm

x2 = .434 ppm

$.434 \text{ ppm} \times \frac{8 \text{ mg soln}}{1.015 \text{ g solid}}$

3.41 ppm

SAN-030 $MgCl_2$



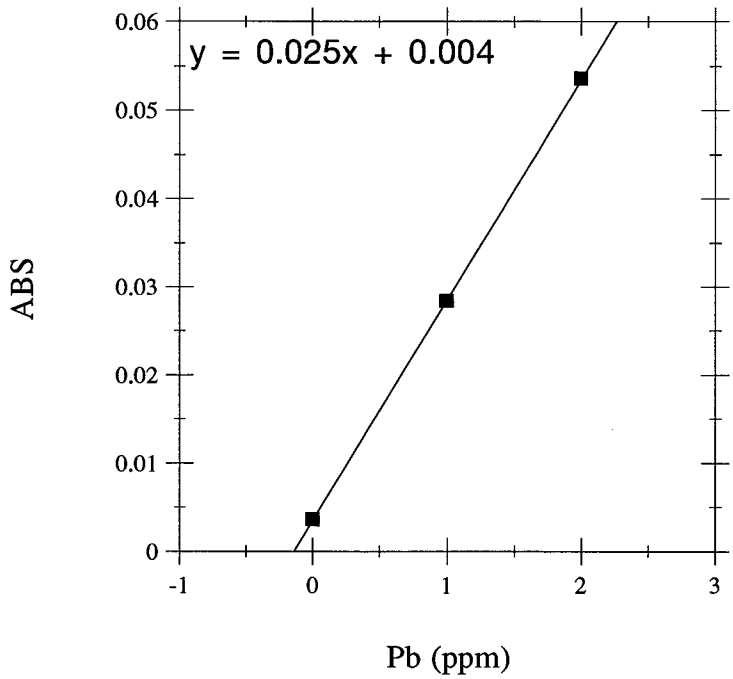
.167 ppm

x2 = .334 ppm

$.334 \times \frac{8\text{ g solw}}{1.023\text{ g solid}}$

2.61 ppm

SAN-023 NaOAc



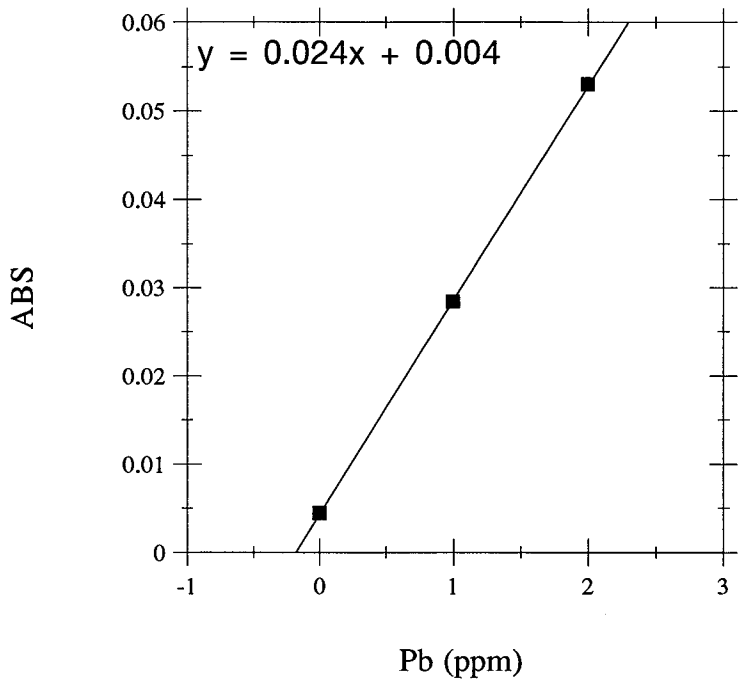
0.16 ppm

x2 = .32 ppm

$.32 \times \frac{8g \text{ soln}}{1.019 g \text{ sol.}} \cdot \ell$

1.256 ppm

SAN-030 NaOAc



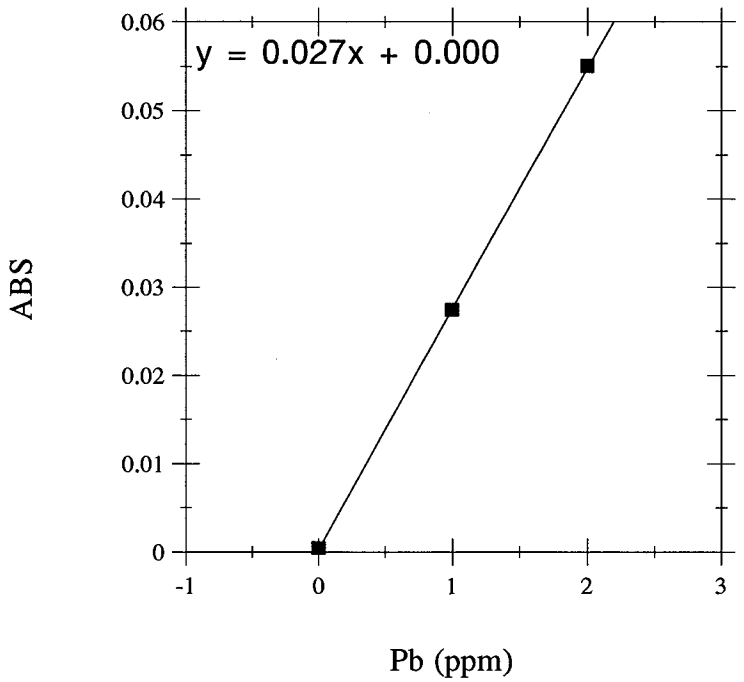
.167 ppm

x2 = .334 ppm

$.334 \times \frac{8\,g\ soln}{1.023\,g\ solid}$

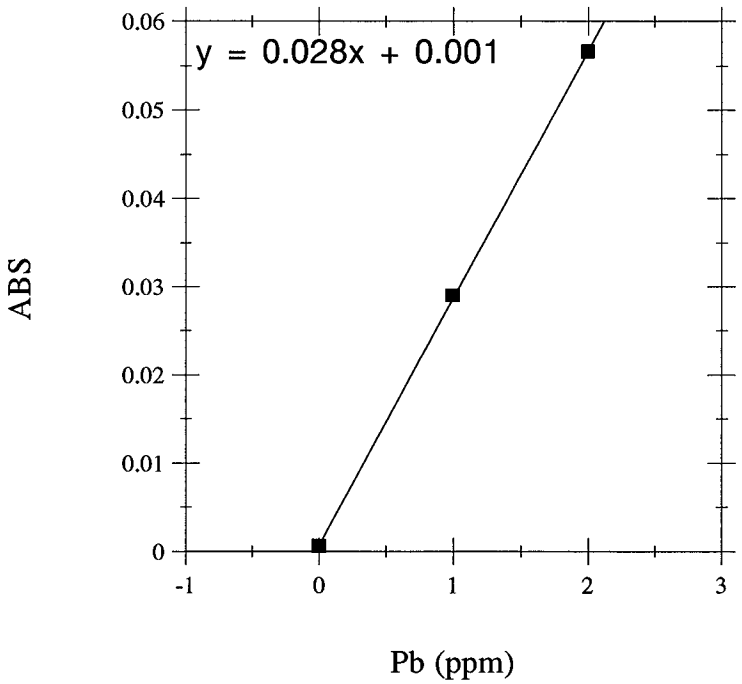
2.61 ppm

SAN-023 NH_2OH



0ppm

SAN-030 NH_2OH



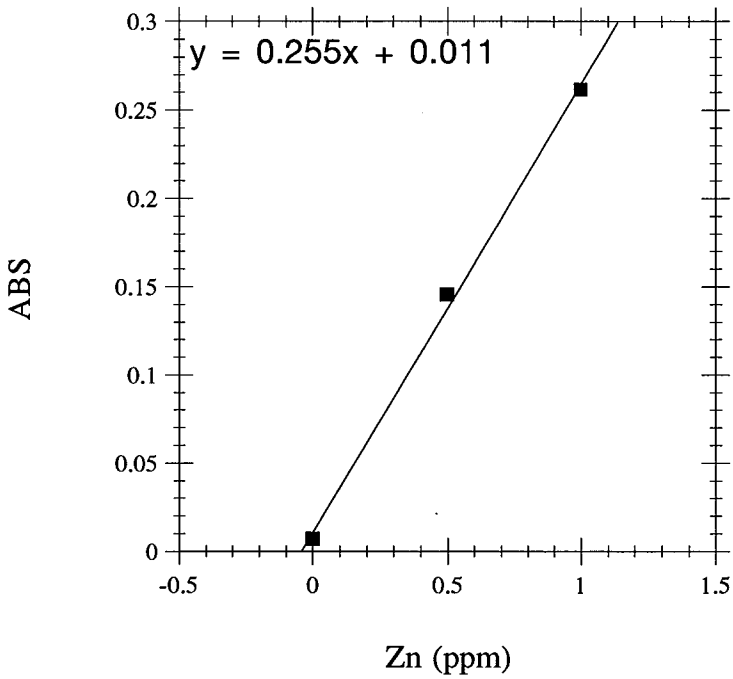
.036 ppm

x2 = .072 ppm

$.072 \times \frac{8\ g\ solw}{1.023\ g\ sol.\ \emptyset}$

.563 ppm

SAN-023 $MgCl_2$



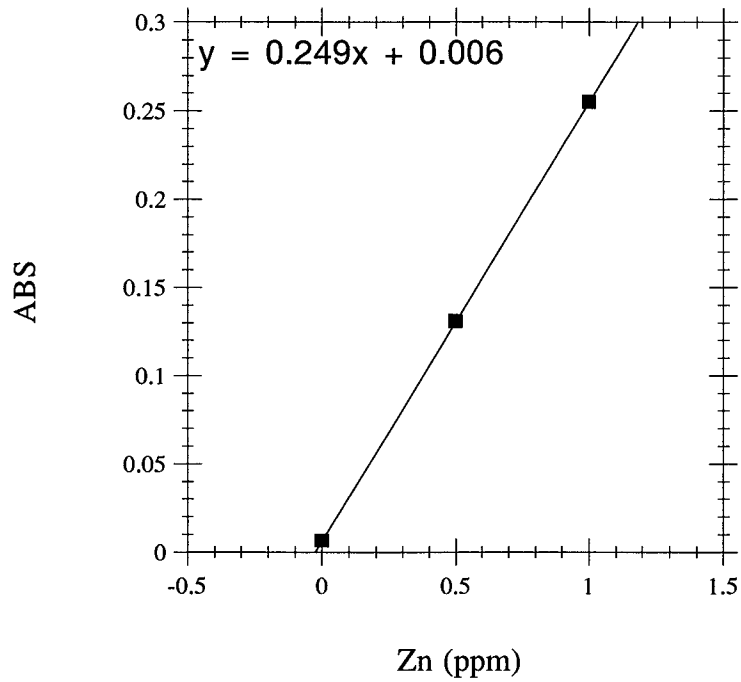
.043

x2 = .086

$.086 \times \frac{8g \text{ soln}}{1.019 g \text{ soln}}$

.1675 ppm

SAN-030 $MgCl_2$



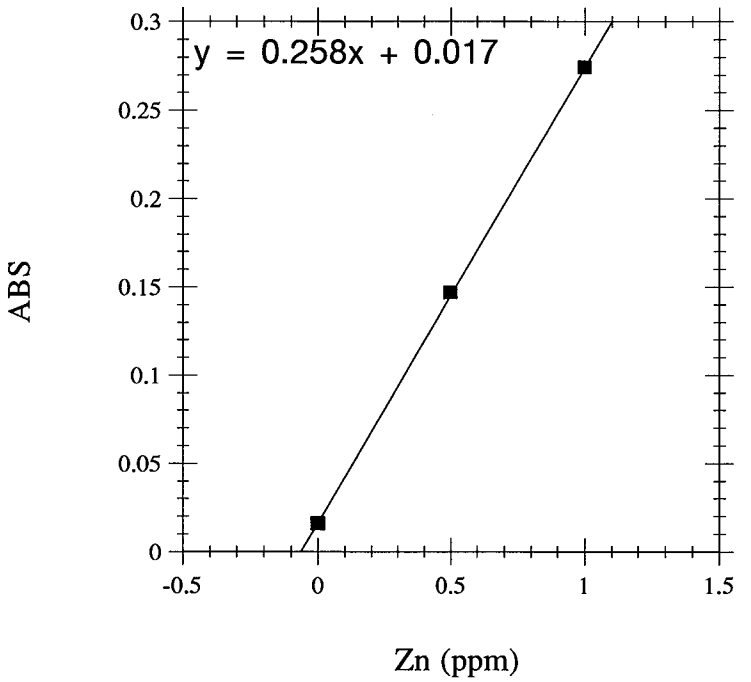
.024

x2 = .048

$.048 \times \frac{8\text{g sdw}}{1.023\text{g solid}}$

.375 ppm

SAN-023 NaOAc



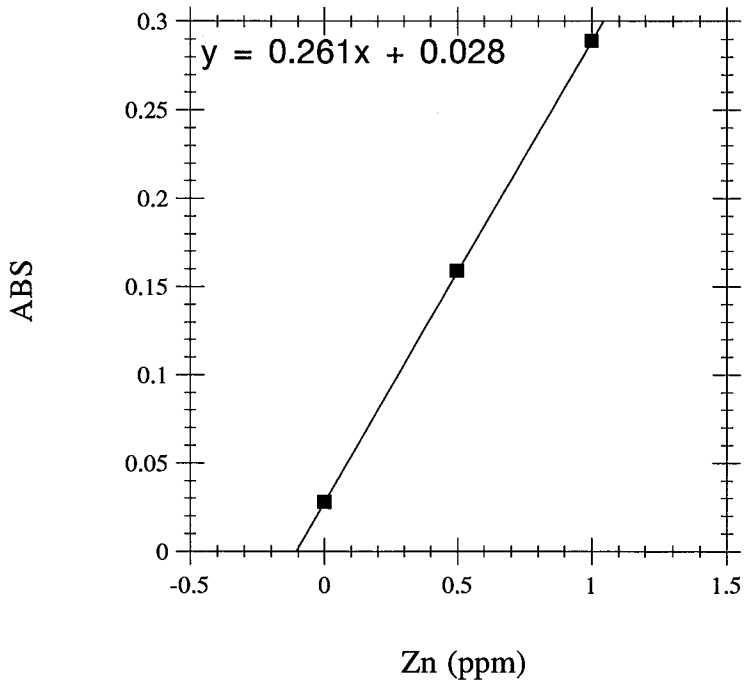
.066 ppm

x2 = .132

$.132 \times \frac{8g \text{ soln}}{1.019g \text{ solid}}$

1.036 ppm

SAN-030 NaOAc



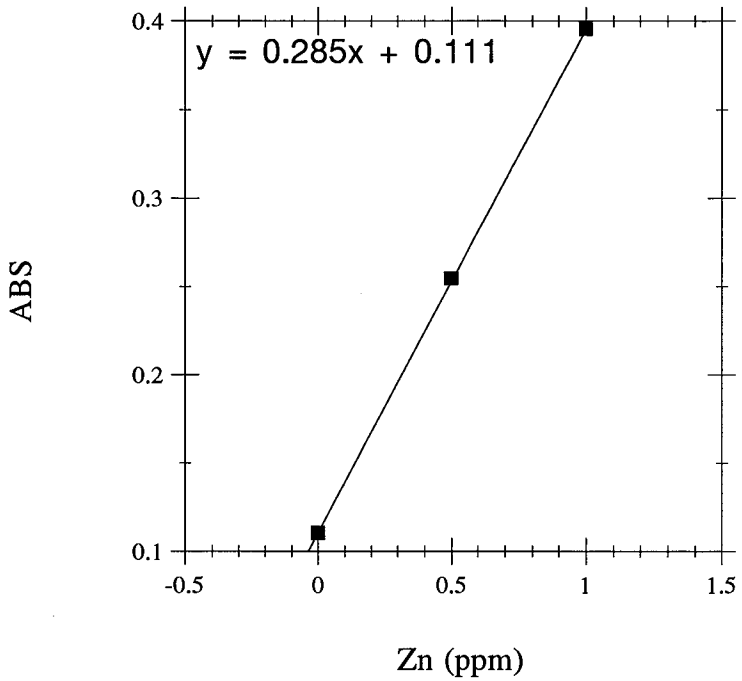
.107

x2 = .214

$.214 \times \frac{8\ g\ soln}{1.023\ g\ sol.\ \theta}$

1.67 ppm

SAN-023 NH_2OH



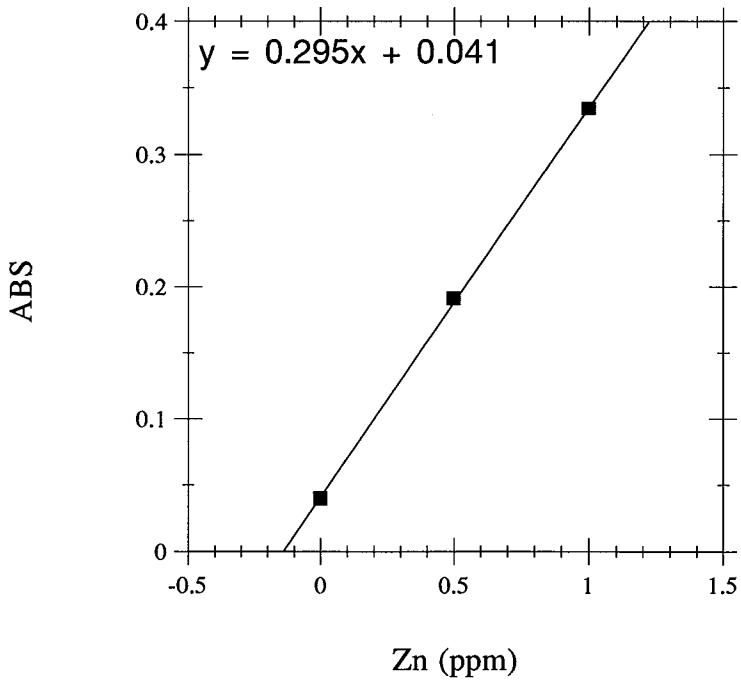
.389 ppm

x2 = .778 ppm

$.778 \times \frac{8 \text{ g soln}}{1.019 \text{ g solid}}$

6.11 ppm

SAN-030 NH_2OH



.139 ppm

×2 = .278 ppm

$.278 \times \frac{8\text{ g soln}}{1.023\text{ g sol.}}$

2.174 ppm

10/2/92
BWL

Santorini Metal analyses.

In an effort to determine whether there is any residual Cu and other metal elements found in bronze that had been leached from the bronze artifacts on the soil near where the articles had been found, aliquots of several samples were leached with a $MgCl_2$ solution (Tessier et al., 1979) (see 031/133).

This leach should release any adsorbed metals. Since Cu is dominant element in bronze, it was decided to analyze for this element first. Additional atomic absorption (AA) standards for Fe & Mn were made as well.

Cu: Standard Preparation. Using 1000 ppm Cu solution (Lot 913830-24) in 2% Nitric acid the following standards were made using volumetric glassware. The aliquot was diluted to the appropriate volume with 1.5 ml HNO_3 (Lot# 910962)/1000 ml solution. Using a 25 ml, 50, 250, & 1000 ml volumetric flasks and a volumetric pipet (1 ml) the following solutions were made. First a 1:10 dilution to make 100 ppm.

1:25	dilutions of the 100 ppm Cu solutions give the working standards with concentrations	4 ppm
1:50		2 ppm
1:250		0.40 ppm
1:1000		0.10 ppm

Mn: Standard Preparation: Using 1000 ppm Mn solution (Lot # 921488-24) in 2% Nitric Acid the following standard were made using volumetric glassware. First a 100 ppm solution was made by a 1:10 dilution. The diluent is 1.5 ml HNO_3/1000 ml. Then the following dilutions were made of the 100 ppm solution:

1:50 ⇒ 2 ppm
1:250 ⇒ 0.4 ppm
1:1000 ⇒ 0.1 ppm

Tessier, A., P. G.C. Campbell, & M. Bisson. 1979. Sequential Extraction Procedure for the Speciation of Particulate Trace Metals. Analytical Chemistry: 51. 844.

10/2/92
BWL

Fe: Standard Preparation: Using 1000ppm Fe solution (Lot # 922056-24) in 2% Nitric acid the following solutions were made using volumetric glassware. First a 100 ppm solution was made by a 1:10 dilution. The diluent in all dilutions is 1.5 ml HNO_3/100 ml. Then working standards were utilized by preparing further dilutions of the 100 ppm solution.

1:25 ⇒ 4.0 ppm
1:50 ⇒ 2.0 ppm
1:250 ⇒ 0.40 ppm.

It was decided first to analyze for Cu by AA. Because of the high salt (Mg) content of these solutions and the low Cu concentrations expected it was suggested (Tessier et al., 1979) that Cu by determined by standard additions method. The following four samples will be used.

SAN-WMM-005 - representative of soil beneath deposit
SAN-WMM-007 - bedrock beneath soil of deposit
SAN-WMM-008 - bedrock some 10 m away from deposit
SAN-WMM-009 - soil some 10 m away from artifact deposit.

The samples had been run in triplicate at a ratio of 1 gm sediment and 8 ml of 1M Mg·Cl_2 (pH=7) and shaken on a wrist shaker for 1 hours. The following results were obtained under the standard operating conditions for Cu with a multi-element lamp. Subsamples #2 & #3 represent an addition of 0.05 & 0.1 ml of 100ppm Cu standard.

005-1	0.08
005-2	1.11
005-3	1.99
007-1	0.07
007-2	1.09
007-3	2.08
008-1	0.06
008-2	1.07
008-3	2.13
009-1	0.08
009-2	1.06
009-3	2.06

These samples were determined by concentrations using a linear standard line using the blank 0.5 ml HNO_3/1000 ml and the 4.00 ppm Cu standard.

These preliminary results using a linear-least squares fitting of the data that

SAN-WMM-005	0.104/gm	
SAN-WMM-007	0.070/gm	Sediment
SAN-WMM-008	0.046/gm	
SAN-WMM-009	0.073/gm	

These results are suggestive that there may be some Cu enrichment, however, these results should not be quoted and are preliminary. The solutions had been in contact with the sediments for over month. The conclusion is that this experiment should be repeated.

10/5/92 BWL Using the samples prepared by OL on (031/132) that have been in the dessicator we will repeat the experiment.

The subsamples were weighed on an analytical balance and transfered into tared, labeled 50 ml plastic centrifuge tubes.

	Tube+Sed +Mg	Mass Used (g)	Tube+sed
SAN-WMM-005-A	22.1943	1.0062	14.1514
-005-B	22.1312	1.0033	14.0978
-005-C	22.2781	1.0014	14.2465
SAN-WMM-007-A	21.8504	1.0010	13.8160
-B	22.3059	1.0018	14.2939
-C	22.2093	1.0011	14.1735
SAN-WMM-008-A	21.7762	1.0012	13.7478
-B	22.2614	1.0015	14.2247
-C	22.3450	1.0038	14.3116
SAN-WMM-009-A	22.2967	1.0021	14.2643
-B	22.2712	1.0015	14.2420
-C	21.8922	1.0014	13.8629
Blank	21.5870		13.5593

10/6/92 BWL Samples were then given an 8 ml aliquot of 1.0 M $MgCl_2$ (pH = 7) (031/131) and reweighed. Samples were shaken on a wrist shaker for 1 hour. The samples were then centrifuged for ten minutes.

as is suggested by Tessier et al 1979. The following metals will need to be determined by standard additions: Cu, Pb, Zn, while Fe & Mn will need to be dilute aliquots of the supernate (20 to 50 x).

So that the standard additions can be done properly it will be necessary to take an aliquot of each of the splits (5 ml) then add 0.05 & 0.10 mls of 100 ppm Cu, Pb, Zn solutions and dilute to volume (10 ml) in volumetric flask with 1.5 ml HNO_3/1000 ml. Aliquot taken with Oxford adjustable pipet.

For the Fe/Mn analysis a 1 ml aliquot will be 1000 ul Eppendorf pipet. This aliquot will be diluted in deionized H_2O to a volume of 25 ml in a volumetric flask.

The standards for Cu, Pb, & Zn should be made with the acidified H_2O as a dilutant. The Cu standards have already been made (024/167).

10/6/92 T.G.

Purpose:

Using Copper, Iron, Zinc, Lead, and Manganese Reference solutions suitable for atomic absorption spectroscopy, various concentrations were made for the approximate determination of the metals found in the soils in Greece.

Materials:

1000 ppm $Cu(NO_3)_2$ in 2% HNO_3 (T.G. Lot# 913830-24)
1000 ppm $Fe(NO_3)_3$ in 2% HNO_3 (Lot#922056-24)
1000 ppm ZnO in 5% HNO_3 (Lot#915748-24)
1000 ppm $Pb(NO_3)_2$ in 2% HNO_3 (Lot#910034-24)
1000 ppm $Mn(NO_3)_2$ in 2% HNO_3 (Lot#921488-24)

100 ml, Class A Volumetric flasks

Cont. 1-10 ml, Class A pipets
~~Eppendorf~~ T.G.
200-1000 uL Eppendorf pipetters
125 ml PP bottles
Several liters of nanopure water.

Procedure:

Using only clean, acid-washed pipets and volumetric flasks, 100 ~~ppm~~ T.G. solutions were ~~diluted~~ T.G. made by diluting each of the 1000 ppm solutions mentioned in the materials list. To do this:

1.) Rinse the pipet with the solution being diluted and then draw 10 ml into the pipet for transfer into the 100 ml Volumetric flask.
2.) Add nanopure water to the flask until the meniscus bottom lies on the mark.
3.) Holding the flasks lid on, shake the volumetric to ensure complete reaction.
4.) Pour the 100 ml (100 ppm) solution into a labeled, 125 ml PP bottle and label accordingly.

5.) If necessary, serial dilutions or more dilutions from the original 1000 ppm Reference solution can be made by following the previous procedures.

10/6/92 T.G.

Purpose:

To determine whether the Santorini metals of interest ~~were~~ T.G. (are) bound in carbonates ~~or~~ and T.G. Iron-Manganese oxides, 5.0 pH, NaOAc and 0.04 M $NH_2OH \cdot HCl$ (in 25% v/v HOAc), respectively, were made. ~~to Determining the extent of~~ T.G. leaching due to carbonate and oxide bonding decreases the observable concentration of the metals in the soil. The above solutions were made to decrease the binding, thereby increasing the number of free metal ions.

10/6
BWL

Reagents:

Sodium Acetate (ACS certified) Lot # 905630
Hydroxlamine Hydrochloride (ACS certified) Lot # $NH_2OH \cdot HCl$
Acetic Acid, Glacial (Reagent A.C.S.) Lot # 893419

Materials:

2-500ml Volumetric flasks ±.001g T.G. 10/6/92
Mettler ~~240~~ AE 240 and PM4600 Balances ±.1g
pH electrode & Meter.

Procedures:

To make 0.04 M $NH_2OH \cdot HCl$ in 25% (v/v) HOAc:

1.) For a 500 ml solution, add 125 ml HOAc to the empty volumetric or weigh [125ml * 1.05g/ml = 131.3g HOAc] 131.3g HOAc into the flask using the balance similar to our PM4600.
2.) Slowly add DI water until ≈ 300ml are in the flask. Swirl.
3.) Weigh out --
$0.04\,M\,NH_2OH \cdot HCl * \frac{64.9g}{mole} * \frac{1L}{1000ml} * 500ml = 1.3898\,g\,NH_2OH \cdot HCl$ --
1.3898g $NH_2OH \cdot HCl$ on a balance ~~simit~~ T.G. w/ ±1mg accuracy and rinse the solid into the flask.
4.) Add DI water until ~ 1-2" in below the mark and swirl. Let the flask solution mix and then dilute to the mark. Reswirl and pour into a dated, labeled PP bottle.

To make 1 M NaOAc (pH = 5):

1.) For a 500 ml solution, weigh --
$1\,M\,NaOAc \cdot 3H_2O * \frac{136.08g}{mol} * \frac{1L}{1000ml} * 500ml = 68.04\,g\,NaOAc \cdot 3H_2O$ --
68.04g $NaOAc \cdot 3H_2O$ into a clean, acid-washed 250 ml beaker
2.) With ~ 200 ml already in the flask, sweep the crystals from the beaker into the flask.
3.) Rinse the remaining crystals into the beaker by washing w/ ~25ml of DI water per rinse & swirl the flask once you get near the mark. Finish diluting to mark.
4.) Using glacial acetic acid and a pH meter, slowly add dropwise, with a Pasteur pipet, some of HOAc in a well-vented area. Make sure that there is constant stirring. Add HOAc until the pH is adjusted to 5.00.

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BWL

Standard additions for Cu, Zn, Pb analysis of 'exchangeable fraction'. The linear range of Zn is 0-1 ppm, Pb (0-20 ppm) and Cu (0-5 ppm) the following scheme will be used. The 100 ppm stock solutions made up by TG on 024/171 will be used to make additions. Because each sample (eg 005) is in triplicate (A, B, C) a standard addition is possible for each A, B, or C the following quantities of Cu, Pb, Zn are added

	A	B	C	in ml
Pb	0	.05	.1	
Zn	0	.025	.05	
Cu	0	.05	.1	

this gives the following concentrations once they have been diluted to 10 ml in volumetric flask (Class A) with 15 ml HNO_3/ 1000 ml DIW. Thus each A, B, C sample had a five ml aliquot of supernate transfered, plus the amounts of 100 ppm Cu, Zn, Pb solutions added.

concentration (ppm)	A	B	C
Pb	—	1	2
Zn	—	0.5	1.0
Cu	—	1	2

note 007-C diluted to slightly more than 10 ml.

10/7/92 Sample aliquots taken from the Santorini leaching experiment of samples SAN-WMM-005, xx-xx-007, -008, & 009 were analyzed for Pb, Zn, Cu, Fe, Mn. The leachate was $MgCl_2$ (pH=7). After the aliquots were taken the remaining solution was decanted. The samples were then washed with 8 ml of deionized H_2O. The H_2O was added using a 5ml & 3ml setting on the adjustable Oxford pipet. All the tubes were capped, agitated on the homogenizer, and centrifuged for 30 minutes. The deionized H_2O was then decanted.

The sample centrifuge (50 ml polypropylene) tubes were opened and to each tube, 8 mls of a 1M NaOAc solution that had been adjusted to pH=5 with acetic acid, were added, using a 5ml and 3 ml transfer volume delivered by the Oxford pipet. This reagent is documented on 024/172. The sample tubes were capped and then agitated on the wrist shaker for 5 hours.

After 5 hours of agitation the tubes were centrifuged for 30 minutes on 7 using the IEC Clinical Centrifuge. Then the supernate were sampled as follows:

Cu, Pb, Zn - subsample: These AA analyses will be by the method of the standard addition. So each A, B, C solution was assumed to be identical. Using a oxford adjustable pipet & disposable tips a 5 ml aliquot was carefully removed and placed into a 10 ml Class A Volumetric Flask. Using AA the linear range for Zn (0-1 ppm), Pb (0-20 ppm) & Cu (0-5 ppm) Using the 100 ppm stock solutions of each element (024/171) the following additions will be made with fixed volume Eppendorf pipets. Samples labels are of the form 5-A*C representing 005-A*C carbonate leachate

element	addition ml / conc added	A	B	C
Pb	~~0/0~~	0/0	0.05/1	0.1/2
Zn	~~0/0~~	0/0	0.025/0.5	0.05/1
Cu	~~0/0~~	0/0	0.05/1	0.1/2

Then all aliquots were diluted to 10 ml using 1.5 ml HNO_3/1000 ml. (024/167)

Fe, Mn subsample: These aliquots will be diluted to variable volumes using the acidic dilutant (024/167). The aliquots were all 1.00 ml delivered by an Eppendorf 1000µl fixed volume pipet with disposable tips. The diluted volumes are given below.

A	1:25	5, 7, 8, & 9
B	1:10	" "
C	1:10	" "

Samples labeled as 005-A~~*~~ C-Fe*25 where it represents the Fe fraction diluted to 25 ml

Blanks for Cu/Pb/Zn and Fe/Mn are simply 5 ml and 1 ml of the Na-acetate solution diluted to 10 ml with 1.5 ml HNO_3/1000 ml.

10/8/92 BWL The remaining supernate was decanted and placed down the sink. 8 ml of deionized H_2O was then added to each tube by delivery of a 3 & 5 ml aliquot from a 5 ml variable volume Oxford pipet. Each tube was capped and then agitated on the Vortex Genie 2 mixer. The tubes were then centrifuged for ½ hour and the supernate decanted into the sink.

The sample centrifuge tubes were opened and to each, 8 mls of a 0.04 M $NH_2OH \cdot HCl$ in 25% (v/v) $HOAc$ (24/172) solution was added using a 3 & 5 ml aliquot delivered by a 5 ml Oxford pipet (adjustable). The sample tubes were capped and then agitated on the wrist shaker for 5 hours.

After 5 hours the samples were removed and centrifuged for 30 minutes. continued on page ~~180~~. 181 BWL 10/12/92

10/12/92
BWL

The atomic absorption spectrometry results for the $MgCl_2$, Na·acetate (pH=5), and Hydroxylamine-HCl - acetic ~~Lea~~ BWL 10/12/92 acid leaches are given below. Using a Perkin Elmer Model 3100;
The following conditions were used during AA analysis. a multielement lamp (Fe, Mn, Zn, Cu,) and a single element Pb lamp.

Element	(ma) voltage	(nm) λ	(nm) slit	Height Resolver	Air	Acetylene
Cu	15 ma	324.8	0.2	H	4	2.5
Zn	" "	213.9	" "	H	4	2.5
Fe	" "	248.3	" "	H	4	2.5
Mn	" "	279.5	0.2	H	4	2.5
Pb	" "	217.0	0.2	H	4	2.5

All samples were run in the flame mode with Fe & Mn analyses ~~accomplished~~ BWL 10/12/92 accomplished by running the 3100 using a linear calibration and standards (024/170) that had been diluted to volume such that any matrix affects were minimized. For example: in $MgCl_2$ leach if 1 ml of sample had been diluted to 25 ml with dilute acid (024/168) then the standards of Fe were 1/25 $MgCl_2$ leachant. These analyses for Fe & Mn were diluted by either a 1:10 or 1:25 dilution, as suggested by Tessier et al. 1979.
Since our system doesn't have a printer associated with only the display information is available for analysis.

Parameters used in the Fe&Mn analyses are as follows:
Integration Time = 3 sec
Replicates = 3
Calibration = Linear
Technique = Flame
Std = 2 or 3

10/12/92 1510 hrs JP

Autoradiographic thin section samples were detached from the CR-39 plastic. Total exposure time ≅ 4 days; 16 hours; 20 minutes

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The supernate was sampled after 5 hours of agitation and 30 minutes of centrifugation.

Cu, Pb, Zn - subsample: These AA analyses will be by the method of standard addition. Each A, B & C sediment & supernate aliquot was assumed to be identical. Using an Oxford adjustable pipet and disposable tips a 5 ml aliquot was carefully removed and placed into a 10 ml class A volumetric Flask. Using the AA the linear range for Zn (0-1 ppm), Pb (0-20 ppm) & Cu (0-5 ppm) Using the 100 ppm stock solutions of each element (024/171) the following additions will be made with fixed volume Eppendorf pipettes. Samples labels are of the form 5-A*3 representing SAN-WMM-005-A subjected to the hydroxylamine chydrochloride - acetic acid leachant (024/172).

The standard addition scheme is as follows:

Element/sample	Addition ml/	Concentration Added
Pb -A	0	0
-B	0.05	1.00
-C	0.10	2.00
Cu -A	0	0
-B	0.05	1.00
-C	0.10	2.00
Zn -A	0	0
-B	0.025	0.50
-C	0.05	1.00

all aliquots were diluted ~~were~~ BWC 10/12/92 to 10 ml using 1.5 ml HNO_3/1000 ml (024/167).

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Fe, Mn subsample: These aliquots were diluted to 10 or 25 ml using the acidic dilutant (024/167) using Class A volumetric flasks. The aliquots were all 1.00 ml delivered by an Eppendorf 1000 µl fixed volume pipet with disposable tips. The diluted volumes are given below

A = 1:10 & B = 1:25, C = 1:25

The sample designations are 005-A*3-Fe 10 or
005-A*3-Fe 25

where the 10 or 25 after Fe represents the dilution factor. Blanks for Cu/Pb/Zn and Fe/Mn are simply 5 ml and 1 ml of Hydroxylamine-hydrochloride-acetic acid reagent diluted to 10 ml with acidified dilutant, respectively.

10/13/92 BWL

AA analysis of trace metals in ~~leachates of~~ BWL 10/13/92 leachates of Santorini samples. Because there is no printer associated with the AA in a linear calibration mode only the absorbance of the 1st standard is displayed. Subsequent standards calculated concentration are displayed. For example, the analysis of Fe in Mg(ll) leach experiment used the blank for zero concentration and 0.50 ppm and 1.00 ppm Fe standards for the linear calibration. From the table below an absorbance of 0.023 was read for the 0.50 ppm Fe Standard. The acquisition of the 1.00 ppm then predicted the concentration of 1.02 ppm from a linear calibration of the 0, .5 pair.

Thus the following data tables for Fe & Mn consist of two parts. The first part (upper portion) is the calculated concentrations of the samples based upon the linear calibration of Fe or Mn standards. The lower portion gives the information obtained during standard linear calibration acquisition. The concentrations in the following two tables do not reflect any corrections due to dilutions.

AA ANALYSIS SANTORINI

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Fe Concentrations

MgCl2 Leach			Na acetate -acetic acid			Hydroxylamine hydrochloride-acetic acid		
Sample	Fe (ppm)		Sample	Fe (ppm)		Sample	Fe (ppm)	
005-A*Fe25	0.01		005-A*C-Fe25	0.00		005-A*3-Fe10	1.20	
005-B*Fe25	0.02		005-B*C-Fe10	0.00		005-B*3-Fe25	0.49	
005-C*Fe25	0.01		005-C*C-Fe10	0.00		005-C*3-Fe25	0.50	
007-A*Fe25	0.01		007-A*C-Fe25	0.00		007-A*3-Fe10	1.33	
007-B*Fe25	0.02		007-B*C-Fe10	0.00		007-B*3-Fe25	0.51	
007-C*Fe25	0.01		007-C*C-Fe10	0.00		007-C*3-Fe25	0.52	
008-A*Fe25	0.01		008-A*C-Fe25	0.03		008-A*3-Fe10	0.98	
008-B*Fe25	0.01		008-B*C-Fe10	0.16		008-B*3-Fe25	0.38	
008-C*Fe25	0.01		008-C*C-Fe10	0.16		008-C*3-Fe25	0.37	
009-A*Fe25	0.01		009-A*C-Fe25	0.00		009-A*3-Fe10	0.97	
009-B*Fe25	0.00		009-B*C-Fe10	0.00		009-B*3-Fe25	0.39	
009-C*Fe25	0.01		009-C*C-Fe10	0.00		009-C*3-Fe25	0.37	
Known Concentration	0.50	1.00	0.50	1.00	5.00	0.50	1.00	5.00
Absorbance	0.023		0.024			0.024		
Calculated Concentration		1.02		1.03	4.99		1.12	4.97

Mn Concentrations

MgCl2 Leach			Na acetate -acetic acid			Hydroxylamine hydrochloride-acetic acid		
Sample	Mn (ppm)		Sample	Mn (ppm)		Sample	Mn (ppm)	
005-A*Fe25	0.06		005-A*C-Fe25	0.178		005-A*3-Fe10	1.618	
005-B*Fe25	0.07		005-B*C-Fe10	0.446		005-B*3-Fe25	0.623	
005-C*Fe25	0.07		005-C*C-Fe10	0.449		005-C*3-Fe25	0.624	
007-A*Fe25	0.01		007-A*C-Fe25	0.070		007-A*3-Fe10	0.305	
007-B*Fe25	0.01		007-B*C-Fe10	0.175		007-B*3-Fe25	0.114	
007-C*Fe25	0.01		007-C*C-Fe10	0.175		007-C*3-Fe25	0.111	
008-A*Fe25	0.01		008-A*C-Fe25	0.034		008-A*3-Fe10	0.094	
008-B*Fe25	0.01		008-B*C-Fe10	0.082		008-B*3-Fe25	0.035	
008-C*Fe25	0.01		008-C*C-Fe10	0.080		008-C*3-Fe25	0.035	
009-A*Fe25	0.01		009-A*C-Fe25	0.096		009-A*3-Fe10	1.967	
009-B*Fe25	0.01		009-B*C-Fe10	0.231		009-B*3-Fe25	0.772	
009-C*Fe25	0.01		009-C*C-Fe10	0.232		009-C*3-Fe25	0.763	
Known Concentration	0.10	1.00	0.10	0.50	2.00	0.10	0.50	2.00
Absorbance	0.012		0.012			0.011		
Calculated Concentration		1.02		0.49	2.00		0.49	2.00

The true concentration in units of ppm or $\frac{\mu g \text{ metal}}{g \text{ solution}}$ is then determined by multiplying the result by its dilution factor.

For Example Mn: 005-A*3-Fe10 = 1.618 x10 = 16.18 ppm
005-A*3-Fe25 = 0.623 x25 = 15.58 ppm.

AA Analysis Santorini Leachates

10/13/92 BWL

For standard addition analyses only absorbances are recorded. The following tables represents the data for Pb, Zn & Cu.

Pb Absorbance

	MgCl2 Leach			Na acetate -acetic acid		Hydroxylamine hydrochloride-acetic acid		
Sample	Pb added (ppm)	Absorbance	Sample	Pb added (ppm)	Absorbance	Sample	Pb added (ppm)	Absorbance
005-A	0.00	0.003	005-A*C	0.00	0.004	005-A*3	0.00	0.002
005-B	1.00	0.015	005-B*C	1.00	0.017	005-B*3	1.00	0.017
005-C	2.00	0.029	005-C*C	2.00	0.030	005-C*3	2.00	0.033
007-A	0.00	0.003	007-A*C	0.00	0.004	007-A*3	0.00	0.001
007-B	1.00	0.016	007-B*C	1.00	0.017	007-B*3	1.00	0.016
007-C	2.00	0.029	007-C*C	2.00	0.030	007-C*3	2.00	0.032
008-A	0.00	0.003	008-A*C	0.00	0.004	008-A*3	0.00	0.000
008-B	1.00	0.016	008-B*C	1.00	0.017	008-B*3	1.00	0.016
008-C	2.00	0.029	008-C*C	2.00	0.030	008-C*3	2.00	0.032
009-A	0.00	0.003	009-A*C	0.00	0.005	009-A*3	0.00	0.002
009-B	1.00	0.016	009-B*C	1.00	0.017	009-B*3	1.00	0.017
009-C	2.00	0.028	009-C*C	2.00	0.029	009-C*3	2.00	0.033

Zn Absorbance

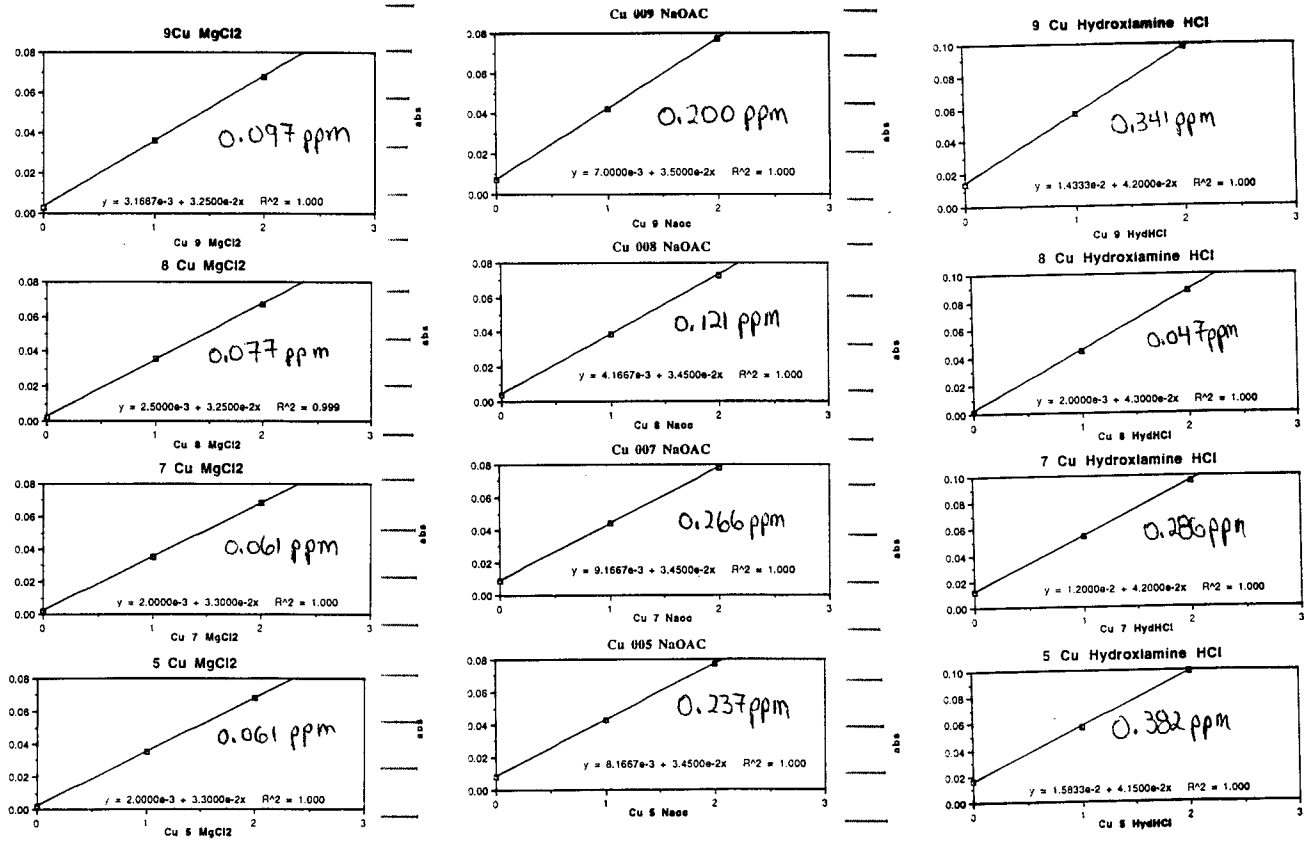
	MgCl2 Leach			Na acetate -acetic acid		Hydroxylamine hydrochloride-acetic acid		
Sample	Zn added (ppm)	Absorbance	Sample	Zn added (ppm)	Absorbance	Sample	Zn added (ppm)	Absorbance
005-A	0.00	0.003	005-A*C	0.00	0.018	005-A*3	0.00	0.102
005-B	0.50	0.052	005-B*C	0.50	0.030	005-B*3	0.50	0.167
005-C	1.00	0.099	005-C*C	1.00	0.041	005-C*3	1.00	0.229
007-A	0.00	0.004	007-A*C	0.00	0.016	007-A*3	0.00	0.060
007-B	0.50	0.053	007-B*C	0.50	0.028	007-B*3	0.50	0.128
007-C	1.00	0.101	007-C*C	1.00	0.041	007-C*3	1.00	0.195
008-A	0.00	0.005	008-A*C	0.00	0.021	008-A*3	0.00	0.016
008-B	0.50	0.053	008-B*C	0.50	0.032	008-B*3	0.50	0.086
008-C	1.00	0.100	008-C*C	1.00	0.044	008-C*3	1.00	0.153
009-A	0.00	0.009	009-A*C	0.00	0.015	009-A*3	0.00	0.114
009-B	0.50	0.054	009-B*C	0.50	0.026	009-B*3	0.50	0.181
009-C	1.00	0.099	009-C*C	1.00	0.038	009-C*3	1.00	0.241

Cu Absorbance

	MgCl2 Leach			Na acetate -acetic acid		Hydroxylamine hydrochloride-acetic acid		
Sample	Cu added (ppm)	Absorbance	Sample	Cu added (ppm)	Absorbance	Sample	Cu added (ppm)	Absorbance
005-A	0.00	0.002	005-A*C	0.00	0.008	005-A*3	0.00	0.016
005-B	1.00	0.035	005-B*C	1.00	0.043	005-B*3	1.00	0.057
005-C	2.00	0.068	005-C*C	2.00	0.077	005-C*3	2.00	0.099
007-A	0.00	0.002	007-A*C	0.00	0.009	007-A*3	0.00	0.012
007-B	1.00	0.035	007-B*C	1.00	0.044	007-B*3	1.00	0.054
007-C	2.00	0.068	007-C*C	2.00	0.078	007-C*3	2.00	0.096
008-A	0.00	0.002	008-A*C	0.00	0.004	008-A*3	0.00	0.002
008-B	1.00	0.036	008-B*C	1.00	0.039	008-B*3	1.00	0.045
008-C	2.00	0.067	008-C*C	2.00	0.073	008-C*3	2.00	0.088
009-A	0.00	0.003	009-A*C	0.00	0.007	009-A*3	0.00	0.014
009-B	1.00	0.036	009-B*C	1.00	0.042	009-B*3	1.00	0.057
009-C	2.00	0.068	009-C*C	2.00	0.077	009-C*3	2.00	0.098

ences 2/13/92
2 BWL

Using the concentrations of added element and the measured absorbance the concentration can be determined by plotting the results and determining the linear least-squared fit of the data. From the equation of the line y = 0 and the concentration x is solved. The following figures give the best fit lines for all the analyses and the calculated concentrations of each sample.



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AA Analysis Santorini Zn & Pb

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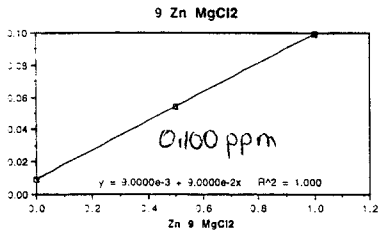

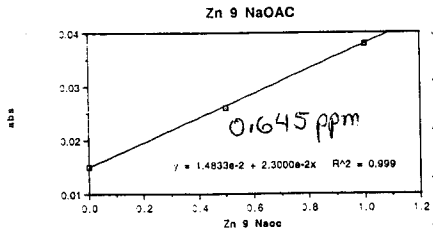

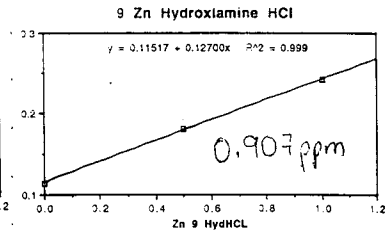

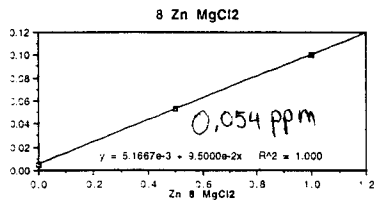

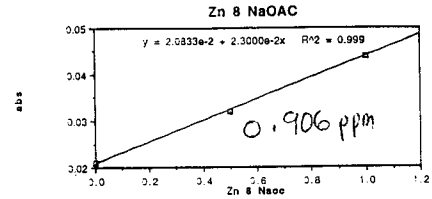

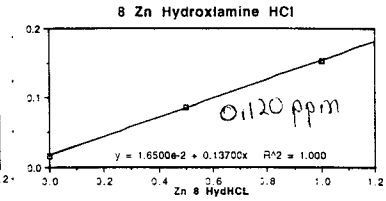

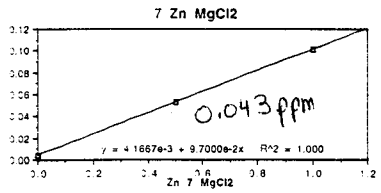

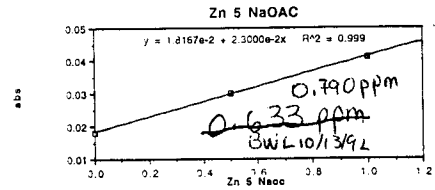

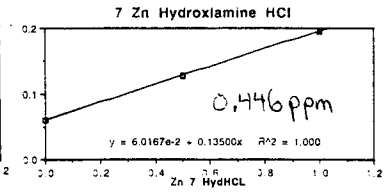

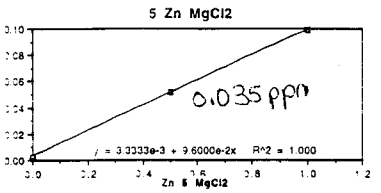

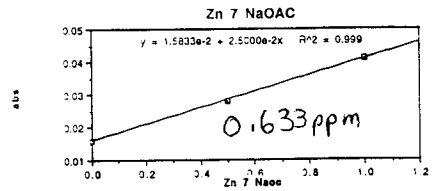

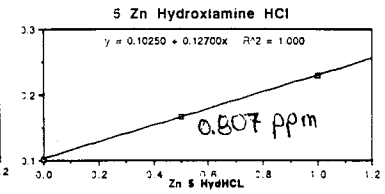

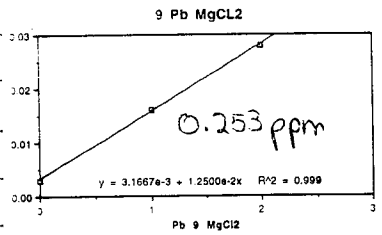

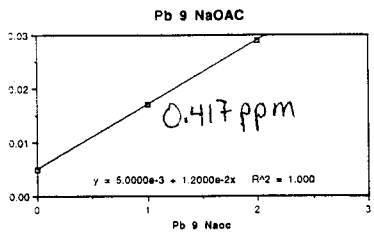

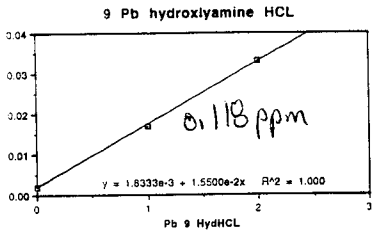

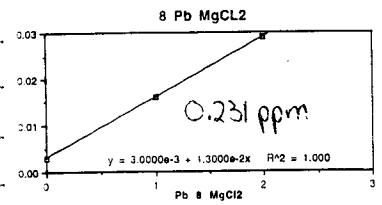

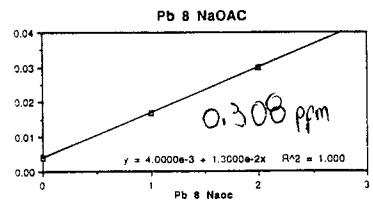

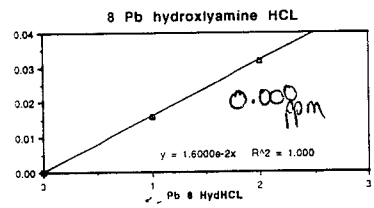

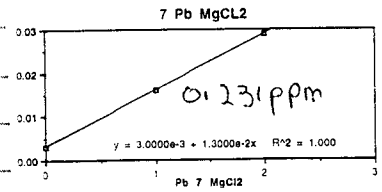

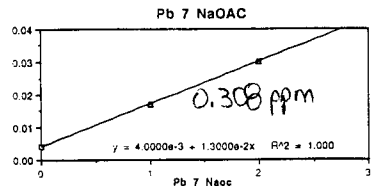

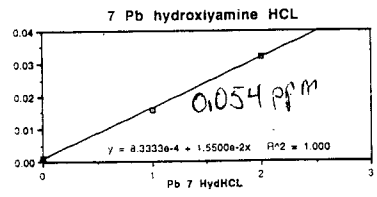

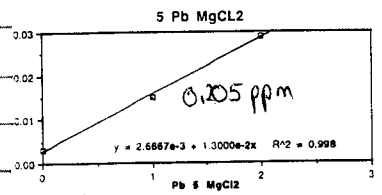

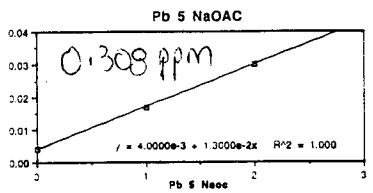

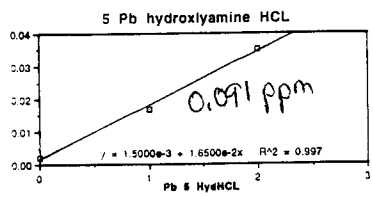

10/13/92
BWL

The final results for Pb, Zn & Cu are calculated as follows: From the figures the concentration is multiplied by the solution mass to solid mass ratio.

Eg. SAN-WMM-009 for Zn Hydroxylamine HCl

$$0.907 \text{ ppm} \frac{8 \text{ g solution}}{1.00 \text{ g solid}} = 7.26 \text{ ppm}$$

The figure of 1.00 gram comes from the average of the masses of the solids used (024/169).

For the Fe & Mn numbers the results for A, B, C are calculated by multiplying by the dilution factor and the leachate to solid mass ratio.

Eg. SAN-WMM-005-A*3-Fe10

$$\frac{1.618 \times 10 \times 8}{1.0062} = 128.64 \text{ ppm}$$

The results of each A, B, & C are averaged and the average is presented below. The carbonate fraction = Na acetate pH=5 & Mn-Fe oxides is the hydroxylamine-hydrochloride-acetic acid leachant.

Santorini Leach Results

		MgCl Exchangeable			
Sample	Cu	Zn	Pb	Fe	Mn
5	0.49	0.28	1.64	2.66	13.29
7	0.49	0.34	1.85	2.66	2.00
8	0.62	0.43	1.85	2.00	2.00
9	0.78	0.80	2.02	1.33	2.00
		Carbonate fraction			
Sample	Cu	Zn	Pb	Fe	Mn
5	1.90	6.32	2.46	0.00	35.60
7	2.13	5.06	2.46	0.00	13.98
8	0.97	7.25	2.46	10.51	6.57
9	1.60	5.16	3.34	0.00	18.72
		Mn-Fe oxides			
Sample	Cu	Zn	Pb	Fe	Mn
5	3.06	6.46	0.73	97.65	125.82
7	2.29	3.57	0.43	104.00	23.10
8	0.38	0.96	0.00	75.97	7.16
9	2.73	7.26	0.94	76.41	154.53